Faculty of Education

MPhil in Education

Thesis Title: Teacher Professional Development in a Rural Zimbabwean Secondary School: An Investigation of Teachers' Perceptions and Practice

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Route: MPhil in Education, Globalisation and International Development

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College: Hughes Hall

Submission Date: 08.07.2019

Word Count: 19, 950

Abstract

This thesis explores and reports on the development and outcomes of OER4schools, a teacher professional development (TPD) programme supporting interactive forms of subject teaching and technology, in a rural Zimbabwean secondary school. Research and literature demonstrates that effective TPD are school-based, long term programmes which offer ample support and space for teachers to become reflective practitioners. Moreover, TPD programmes which utilise interactive pedagogy and accompanying technology can offer significant learning gains for students if appropriately implemented. For this qualitative study, data were collected from lesson observations, teacher interviews, a headteacher interview and TPD session observations to substantiate a comprehensive picture of Zimbabwean teachers' perceptions and practice. The findings demonstrate that these teachers are moving away from rote learning techniques and towards more learner-centred and interactive approaches - practices atypical of this context. Evidence illustrates a shift in teachers' beliefs of optimal pedagogy which is corroborated by classroom experimentation and teacher insight and reflection. The majority of teachers are developing peer learning activities and trialling questioning techniques within their lessons to provide meaningful experiences for their students to enhance their learning. Outside the classroom, teachers appear to be using technology devices to improve their lesson planning and TPD sessions are enabling heightened teacher collaboration and reflection. Yet teachers still face constraints characteristic of sub-Saharan African rural contexts, and therefore require ongoing support to manage these difficulties and to continue to refine their pedagogic skillsets.

Declaration

Acknowledgements

Figure 1: The welcome sign at the entrance to Mpumelelo High School, Nkayi, Zimbabwe.

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Abbreviations

TPD = Teacher Professional Development

SSA = Sub-Saharan Africa

ITE = Initial Teacher Education

LCE= Learner-centred Education

LMIC = Low and Middle Income Countries

OER = Open Educational Resources

SRI= Stimulated-Recall Interviews

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Introduction

'Teacher Quality'

Within recent policy and research, there is unanimity that "the teacher is the most important 'factor' in the education process" (Biesta, 2015, p.75). This is made explicit in policy documents which argue that a quality education system is dependent on teacher quality, and that teacher quality directly impacts and drives student progress (UNESCO, 2014; World Bank, 2018; Burns et al., 2015). Therefore, since the refocus of the 2015 Sustainable Development Goals from education access to education quality, and the realisation that "schooling is not the same as learning", teachers have been re-centred as the most pervasive 'agents for change' (World Bank, 2018, p.3).

The definition of 'quality' education has been furiously debated by different researchers, policy-makers and scholars with varying agendas (Sayed & Ahmed, 2015; Alexander, 2015; UNESCO, 2000)[1]. Yet this thesis draws on the works of Bainton et al., (2016) to specifically examine the facet of 'teacher quality': "teachers' professional capabilities in order to improve learning outcomes" (p.6). This involves both teachers' professional knowledge and expertise that they bring to the classroom, and the wider education system such as supportive policy, community and school environments (ibid.). Although the complexities of external and internal processes are acknowledged, this thesis focuses wholly on the use of teacher professional development (TPD) programmes as a means to effectively develop the professional capabilities of teachers to enhance student learning.

Teacher Professional Development in sub-Saharan Africa

As teachers come from a range of backgrounds, with varying degrees of Initial Teacher Education (ITE) levels, continuing professional development throughout teachers' careers is essential (Karras and Wolhuter, 2010; UNESCO, 2014). To address teacher shortages when increasing access in sub-Saharan Africa (SSA), recruitment of unqualified or underqualified teachers into the profession has become typical (Mukeredzi, 2013)[2]. This has had a detrimental impact on student outcomes: research shows that students perform considerably worse when being taught by teachers who have received no teacher training (Kruijer, 2010). However, even when teachers do receive effective ITE, learning to teach is a process and teachers need both on-going support and supervision to provide them with the skillsets for a challenging career (Conway et al 2009; Nakabugo et al., 2018).

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[1] This study views 'quality' education as the processes of teaching and learning within the classroom which focus on promoting inclusive and equitable student learning (Tikly & Barrett, 2011).
[2] The Sustainable Development Goals Report in 2018 estimates that only 61% of teachers are trained in sub-Saharan Africa (UN DESA, 2018)

Therefore, many see the establishment of an effective TPD as the 'hinge' for student improvement (Villegas-Remers, 2003; UNESCO, 2014; World Bank, 2018). Especially in low and middle income countries (LMIC), education reformation proposals often highlight TPD as critical to positive change and millions are spent every year to strengthen teachers' performance and subsequently student achievement (Nakabugo et al., 2011; World Bank, 2018; Dembélé & Lefoka, 2007).This is because research has shown TPD as a highly effective platform to impact and enhance 'teacher quality' by: shaping teachers' attitudes and classroom, foster more motivational cultures within the school and help teachers adapt to new curricula and students with varying needs practices (Stoll et al., 2012; Guskey, 2002; UNESCO, 2014).

Yet, the effectiveness of these TPD programmes evidently depends on their focus and a variety of structural and underlying characteristics. Certain types of TPD deliver higher learning gains than others, and many outdated and unsuccessful methods persist (World Bank, 2018). Pryor et al. (2012) note that despite TPD inclusion in policy discourse, it has remained in SSA as "an analytical tool used by researchers rather than as a description of a coherent framework that has been implemented" (p.473). Numerous TPD programmes that have been implemented in SSA have either not been adequately measured nor reached their objectives to fundamentally influence teachers and improve education (Westbrook, 2013; Korthagen et al. 2001; Lauwerier & Akkari, 2015). A coherent framework of TPD in SSA contexts is still relatively elusive due to stakeholders who hold multiple expectations and priorities and the general lack of empirical research surrounding the area (Burns et al., 2015).

Thesis aims and structure

This thesis aims to contribute towards the wider literature in relation to TPD in SSA through a case-study of a TPD programme implemented in Mpumelelo High School, a secondary school in rural Zimbabwe. The intended audience for this thesis is all educational stakeholders (policy-makers, teacher unions, external funders/NGOs, school-leaders, teachers etc.) who are involved and invested in 'teacher quality' and student learning in similar SSA contexts. This school used an adapted version of the 'OER4schools' Open Educational Resources to support teachers to use more interactive pedagogies and ICT within their practice through a school-based, peer-learning TPD programme. The first employment of this TPD programme was in Zambian primary schools in 2010 which resulted in a continual change in teachers' thinking and practice (Haßler, Hennessy, Cross, Chileshe & Machiko, 2014). Therefore, this phase is the trialling of the OER4school materials in a different country and schooling stage.

The overarching research question that this thesis intends to explore is: What do secondary school teachers' perceptions and practice reveal about the outcomes of a TPD programme for interactive teaching and technology use in rural Zimbabwe? A methodological triangulation approach was used to address this question to ensure higher degrees of validity and reliability in the findings. 12 teachers participated in both Stimulated Recall Interviews (SRI) and video-recorded lesson observations, a semi-structured interview was conducted with the headteacher and unstructured observations were carried out over seven TPD sessions. All of these data collection methods were used to ensure a fully integrated research design through a central focus on teacher perceptions and practice leading to student learning.

The first chapter in this thesis provides an overview of literature relating to the key areas of the OER4school TPD programme. Firstly, prior research is used to distinguish the TPD characteristics found to have the most beneficial impacts on supporting teachers in similar contexts. This analysis is used to illustrate both the strengths and continued considerations of the TPD at Mpumelelo High School. Secondly, the pedagogy of 'interactive teaching' is explored under the umbrella of Learner-Centred Education (LCE) in SSA contexts. The need for reforms to centralise pedagogy is established, and the accompanying barriers faced in previous LCE pedagogical reforms are discussed. Lastly, the potential and current uses of technology within educational spaces are analysed in relation to the need for TPD and contextual support.

In the second chapter, the OER4schools programme's content, aims, structure and underpinning theories are discussed in light of the previously discussed TPD research. A contextual overview of the background and context of Zimbabwe's secondary educational system follows, and the requirement and potential of TPD in this specific area are established to provide the educational rationale for this study. The setting and background of Mpumelelo High School is presented, and the TPD structure of the OER4schools programme is described and explained. The research methods Chapter 3 offers an in-depth description and analysis of the chosen methodological approach of this study. Data collection and data analysis procedures selected to address the research question are extensively described, justified and critiqued through appropriate methodological literature and contextually relevant factors. Chapter 4 provides a detailed presentation of the findings from interviews, lesson observations and TPD observations. These data sources are integrated using a thematic structure, framed by social constructivist underpinnings and extant literature, to offer a comprehensive picture of the results through corroboration and contrast. Finally, the concluding chapter reviews the OER4school model in relation to the findings in Chapter 4 and offers recommendations for subsequent areas of improvement and needs for future research.

CHAPTER 1: Literature Review

This chapter provides an overview of surrounding literature that engages with the key areas relevant to the Zimbabwean teacher professional development (TPD) programme examined in this thesis. The role of TPD programmes, interactive teaching, the use of ICT in educational contexts are all discussed in relation to improving the quality of education in global South contexts. The contemporary literature and research surrounding these areas are surveyed, and links are simultaneously highlighted to demonstrate their crucial reliance and overlap. Firstly, the review establishes the criticality of TPD in SSA and the desired programme characteristics conducive for a successful, long-lasting implementation and execution in LMIC countries. Then, it explores how TPD programmes can be harnessed to promote the use of interactive pedagogy and digital technology within educational contexts to offer great potential and support for student learning.

1.1 Teacher Professional Development Characteristics

1.1.1 Frameworks and Scale

The timeframe of TPD programmes can have a considerable impact on the degree of lasting change. Burns et al., (2015) note that when SSA governments provide TPD provisions, they are usually very short courses – lasting days or even hours. These episodic, inconsistent courses are often of low quality and unlikely to have a great deal of impact (World Bank, 2018). Instead, TPD should be approached as a process, rather than a singular event; teacher improvement is a continuous, on-going endeavour (Guskey, 2002; World Bank, 2018; Conway et al., 2009). For example, in Senegal's cluster-based TPD programme, a 10-day training course was given to teachers on the introduction of the approach and content of the new curriculum. Though teachers appreciated taking part, they found it too short and general to affect their practice (Pryor et al.,2012). Similarly, Cannon and Hore (1997) found, through a TPD programme in Indonesia, that there were minimal long-term effects of 'one shot' courses and that they are "at risk of being a largely wasted activity" (p.41).

Research also indicates the advantages of school-based training. If the programme is completed in a dissimilar setting to the one the teacher works in, they may struggle to transpose the content in their local context (Bett, 2016; Gathumbi et al., 2013). In contrast, if trained in their schools, teachers will be able to simultaneously learn and integrate strategies within their classroom practice, make use of the accessible resources and construct new meanings with surrounding colleagues who can play a supportive role (Hardman et al., 2015; Moon, 2007). Findings from a pilot TPD programme in Tanzania demonstrated that school-based training, built on existing systems and structures, allowed

observation and feedback with more experienced colleagues and support from other relevant actors within the school (Hardman et al., 2015).

However, many school-based programmes can be expensive (World Bank, 2018). An alternative to in-service delivery is distance education which not only reduces cost but can reach geographically remote schools and similarly allows teachers to continue to teach instead of taking them out of the classroom (Nakabugo, 2011; Pontefract & Hardman, 2005). These are structured TPD supported by long-distance resources and carried out in regular school 'clusters' or teacher meetings. The shift towards these more flexible school-based provisions has been advocated as a successful way to close the gap between teachers' theory and practice (Hardman, 2011). Using case studies from countries in East Africa, Hardman et al. (2011) makes a strong case that the ideal TPD would use face-to-face delivery coupled with this distance learning. For example, in the Ugandan model, teacher educators provide occasional face-to-face mentoring, whilst other school teachers are facilitators in school 'cluster' meetings (ibid.).

1.1.2 Content and Material

Evidently, the type of content, materials and underpinning pedagogies that the TPD programmes employ are instrumental in achieving particular outcomes. TPD interventions offering materials that are contextually and culturally informed are going to have an overall greater impact (Orr et al., 2013). They should take into account teachers' existing knowledge and ITE training, the requirements of the national curriculum and exams, and the challenging conditions that the teachers face (Stoll et al., 2012). This moves away from the top-down approach that has the 'one size fits all' orientation and acknowledges the need to differentiate and vary courses according to teacher needs (Antoniou & Kyriakides, 2011).

Often TPD programmes are very pedagogy heavy without a focus on actual implementation and the practical implications for developing teaching in their own classrooms (Hennessy, et al., 2016). Although this pedagogical aspect should be present, there should be a focus on specific teaching practices to actually increase these skills within the classroom (Antoniou and Kyriakides, 2011). Moon (2007) corroborates this by concluding that teacher education needs to focus on core, daily classroom skills and understanding – particularly those that are effective in raising student achievement. Since the aim of all TPD programmes should be to support teachers in order to subsequently improve the quality of education for their students, the content focus of these programmes should be promoting an emphasis on learning (Villegas-Remers, 2003).

1.1.3 Collaboration, Exchange, and the 'Reflective Practitioner'

A TPD that offers forms of teacher collaboration is highly advantageous to the programme's effectiveness. Firstly, if teachers are working in a team, they are able to identify and solve common issues and find appropriate solutions (Bett, 2016). These types of collaborative inquiry and peer learning can allow further knowledge to be constructed as a greater wealth of experiences, practices, challenges and apprehensions can be shared and applied to practice (Nakabungo, 2018; Stoll et al., 2012). For example, in Democratic Republic of Congo, the use of Teacher Learning Circles (TLCs) over a sustained period of time promoted a culture of sharing technically, socially and emotionally. Teachers became accountable to each other to try out new teaching methods and used each other to learn and refine new strategies (Frisoli, 2013, p.236).

Teacher collaboration and exchange can also lead to the goal of teachers as 'reflective practitioners' (Villegas-Remers, 2003). This concept has been endorsed as a key goal of many TPD programmes as it encourages the teacher to reflect and self-interrogate their teaching practice leading to intentional change (Stoll et al., 2012). By evaluating their classroom experiences and outcomes, TPD becomes "transformative, given that it was through reflection that new knowledge was constructed and then applied in subsequent activities" (Mukeredzi, 2013, p.97); teachers' practice will continually improve and have the ability to account for new changes and challenges that they may face.

1.1.4 Continuous Support

However, many of these long-term projects have a major theoretical flaw: they assume that if the world's poorest teachers receive a steady diet of TPD training, they will learn new strategies and skills and consequently transfer this quality of learning to their students (Burns, et al. 2015). A vital oversight of this assumption is the need for continued support and follow-up. Without this support, there is risk of teachers either not implementing the training within their classroom, implementing it poorly, or implementing it but quickly reverting back to previous ways (ibid; Cannon and Hore, 1997).

Teacher 'support' should be viewed as multi-layered, and be inclusive of instructional support, technical support (in the case of using new resources), school community support, school-leadership support and more (Burns et al., 2015). Leaders in educational institutions are critical in ensuring whether professional development is great or not (Stoll et al., 2012). In particular, headteachers are pivotal as they are often responsible for implementing the training and allocating time when teachers should be completing sessions (Mukeredzi, 2013). Providing, collaborating with, and securing support with stakeholders is crucial to maintain teacher motivation and improvement which subsequently ensures the functionality and long-lasting impact of the programme (Bennell & Akyeampong, 2007).

1.1.5 Technology as a TPD Platform and Accompaniment

Technology can be used as a proficient tool and medium of TPD. It offers the opportunity to enrich the pedagogic toolkit of teachers in "undreamt-of ways" (Moon, 2007, p.363) and can be utilised as a cost-effective method to provide training and support from a distance to a large number of teachers (UNESCO 2014). For instance, Jukes et al. (2017) evaluated a TPD programme to support literacy on the Kenyan coast which used a weekly text-message provision. This was an extremely low-cost and successful strategy used to support teachers: the response rate to the texts was high, and the teachers reported that they were greatly valued.

Technology has also been used as a platform for teachers to access teaching and learning resources as well as the content of TPD programmes. In South Africa, in an initiative known as 'ICT for rural education development' (ICT4RED), teachers were given tablets to access weekly modules of TPD sessions. They also used these to complete their TPD 'homework' to demonstrate their continuous progress (Botha & Herselman, 2013). These digital devices offer other opportunities to enhance teacher performance. For instance, teachers who have online access are able to use the web to research content for their lessons and communication platforms – such as skype – can be mobilised to allow regular communication or even allowing a teacher and TPD coach to work together to give specific, tailored feedback. However, these uses are limited to those with access to a quality internet connection – which excludes many in rural, fragile and low-income settings (Lawrie, 2015).

Overall, it is evident that technology has the potential to add tremendous value to the TPD experience of teachers in terms of heightened support, access, communication and reflection. However, there are many crucial factors required in its successful application that demand consideration. The extent to which ICT is used as a TPD medium is dictated by technology resources and infrastructure (UNESCO, 2014). Distance education programmes that exploit technology for access and scale still need to be of adequate quality, provide print copies as backups if technology fails, and must be simultaneously complemented by mentoring and face-to-face support at key stages (ibid.). ICT is TPD programmes' accompaniment, not panacea: it cannot replace face-to-face contact nor solve the embedded human and institutional issues within fragile contexts (Lawrie et al., 2015).

Summary

Research and literature illustrates that TPD should be valuable and effective, whilst also cost-effective and scalable. Productive TPD programmes are long-term, school-based, with a strong element of practical classroom skills and student learning. The 'reflective teacher' and focus on student learning should be at the heart of these programmes, enabled through teacher peer-learning, discussion and collaboration. Stakeholders at all levels of the programme need to be given adequate support and

strong school leadership is necessary. When appropriate technology resources are available, TPD programmes can utilise these for distance learning and cost-effective on-going support. Essentially, the approach should always be bottom-up, and consider the specific contextual and cultural needs of the teachers and school. This specificity should be demonstrated through the TPD goals, content and management.

1.2 Pedagogical reform and implementation

1.2.1 Refocus of pedagogy and classroom processes

A great teacher professional development programme is fundamental to great pedagogy and consequently student learning (Stoll et al., 2012). Pedagogy is thus a component that needs to be centralised within the discussion in the quality debate. Alexander (2015) argues that despite "pedagogy's pivotal role….it remains the missing GMR (Global Monitoring Report) ingredient" (p.1). Although the links between teacher quality and classroom practice are evident and empirically proven, usually the focus is primarily on teachers – in terms of numbers, uptake, retention etc. – rather than on their teaching (Alexander, 2015; Westbrook et al., 2013; Schweisfurth, 2015). Pedagogy, rooted in social and cultural contexts, happens whenever teachers are teaching, and is both the act and discourse governing their thoughts and moves: teachers need to know what to teach, how to teach it and why they are teaching it (Alexander, 2015; Schweisfurth, 2015).

1.2.2 'Learner-Centred Education' (LCE) and Interactive Teaching

'Learner-centred education' (LCE) methods are often seen as a vision of best pedagogy and are explicitly promoted by key international organisations such as UNESCO and UNICEF (Schweisfurth, 2015). This label is used to include a wide variety of learning approaches that generally focus on elements such as: high learner motivation and cognitive engagement, mutual respect between teachers and students, dialogic teaching, encouraging students to 'learn to learn', autonomy of learning, collaborative learning, establishing a conducive learning environment and teacher as a 'facilitator' rather than instructive transmitter (Alexander, 2008; UNESCO, 2014; Moate & Cox, 2015; Schweisfurth, 2015).

This type of ideology stems from the educational constructivists such as Piaget (1977) and Vygotsky (1962). Piaget, for instance, acknowledges that knowledge is not transmitted, but a construction in the mind through an active, interpretation of knowledge. Whereas through Vygotsky's 'zone of proximal development', we can see the teacher as the facilitator of knowledge to guide and scaffold a learner to the new and unknown. Teaching methods underpinned by these theorists are viewed as the antithesis to rote and passive learning styles which, in contrast, are dominated by didactic instruction, recitation,

and low student interactivity (Hardman, 2012; Sriprakash, 2010). Research has demonstrated that exclusive use of these more traditional practices can lead to the "stifling of critical and reflective thinking" (O'Sullivan, 2004, p.585) and failure for learners to develop problem-solving skills (Mayer, 1999; Bringle & Hatcher, 1999). Seen as the 'antidote' to these issues, LCE attempts to increase student autonomy, promote lifelong learning by focusing on the needs and experiences of the learner, and has been shown to improve student quantitative measurable outcomes (Schweisfurth, 2015).

 'Interactive teaching' falls under the wider umbrella term of LCE and comprises of similar learner-centred components and underpinning research and theories. It is both an approach and cultivation of a learning environment "where teachers create and take up opportunities to facilitate a two-way discussion with learners, promote hands-on activities and open-ended questioning, and engage students as active participants in the learning process" (Haßler et al., 2014, p.3). The goal is to support students in effective whole class dialogue and questioning, peer learning through group work, and enquiry-based problem-solving activities.

1.2.3 LCE shifts in the global south

Especially in LMIC, rote learning methods are often prevalent due to poor ITE and teachers reflecting how they were taught at school within their own classrooms (Hardman, 2012, UNESCO, 2014). However, in recent years, these countries have experienced a paradigm shift towards LCE reforms as a contemporary pedagogical ideal (Schweisfurth, 2015; Westbrook, 2013; UNESCO, 2014). These changes are often supported by donors, and accompanied by official shifts in curriculum and assessment policy designed to lessen the significance of examinations and therefore stimulate the movement of learner-centred pedagogies (Chisholm & Leyendecker, 2008). At local levels, the ideas are also received favourably as the methods are viewed as vehicles to achieve economic, social and political goals (ibid.) Teachers express enthusiasm for these pedagogies and are often positive when describing its use in their practice (Schweisfurth, 2015).

1.2.4 Barriers and considerations

Yet, despite this majority of acceptance and driving force, there is overwhelming research demonstrating that there are challenges in permeating these approaches in LMIC: unfortunately, "the idea has not taken root in classrooms" (Chisholm & Leyendecker, 2008, p.197). LCE research in LMIC narrates a range of consistent "policy-intention-practice" gaps that are barriers to this paradigm transformation (Schweisfurth, 2015, p.262).

Ultimately, teaching and learning are deeply embedded in the contexts where they take place and are therefore dependent on present culture, resources, institutions and policies (Schweisfurth, 2015).

Therefore, when introducing new teaching pedagogies to LMIC, important considerations must be taken to avoid simply 'parachuting in' Western approaches that ignore key contextual and cultural elements (Schweisfurth, 2013; Brinkmann, 2015). For example, incompatible examinations and huge content-based curricula may force teachers and learners to prioritise these, usually by using through rote learning methods to quickly cover the expansive content (Schweisfurth, 2015; Brinkman, 2015).

Moreover, O'Sullivan's (2004) case study, which explored the non-implementation of LCE approaches of a TPD programme in Namibia, discovered several contextual and cultural barriers. Often the class sizes in SSA can range from 60-80 students, which evidently compromises the teaching and learning of LCE approaches which presuppose space, resources and small classes (O'Sullivan, 2004; Sifuna, 2007). Furthermore, within the ideology of LCE aspects such as collaborative, inquiry-based learning clash with cultural structures: in Namibia the relationship between adult and child is respect and authority and the child is not encouraged to question (O'Sullivan, 2004.). Effectively, LCE is asking the society to revise the way all its adults and children interact as it is "in direct contrast to the case study cultural context" (ibid. p.596). Yet, it is not only the teachers who are required to try new methods, but also the students (ibid.). From only being exposed to rote learning methods, students must adapt to a new responsibility within the classroom and find their voice. Though this is similarly a process, it must be difficult for teachers initially to coerce contributions from unwilling students – leading them to believe "'our type of children are not able to learn in learner-driver ways" (Hennessy et al., 2014, p.24).

Implementing deep change is embedded in the complexities of teachers' beliefs and mind-sets. This can be a difficult process involving loss, anxiety and struggle through its "striking at the core of learned skills, philosophies, beliefs and conceptions of education, and creating doubts about purpose, sense of competence, and self-concept" (O'Sullivan, 2002, p.224). Therefore, change may require an analysis of how to facilitate shifts in teachers' beliefs, before trying to adjust teaching practice (Brinkmann, 2015). However, even if teachers are convinced by LCE approaches, the actual implementation of these methods are highly challenging; if teachers lack confidence, they may quickly return to established rote learning patterns (Haßler, 2014). Thus, trends of discrepancies may start to emerge between teachers' pedagogical understanding and beliefs, and teachers' day-to-day classroom practice.

Finally, most teachers' practice is based on their own schooling experiences, plus any received ITE (Hardman, 2012). As teacher education (ITE and TPD) is rarely learner-centred, no suitable models are available upon which to base their practice, so rote learning is perpetuated (Schweisfurth, 2013). Thus, using dialogic and interactive approaches within TPD sessions can help foster many reflective

and collaborative teacher skillsets as well as providing a similar structure to their own classrooms (Haßler et al. 2014).

Summary

Learner-centred approaches and pedagogies have the scope to provide substantial benefits to learners in LMIC. However, many scholars have noted difficulties with its application in particular contexts and endorsement as the vision of best practice (Schweisfurth, 2015). Major barriers oppose its sustainable implementation: challenging contexts, cultural frameworks, teachers' personal experiences and beliefs within education. These educational shifts must therefore be recognised as a complex process that require on-going dialogue with teachers and educators. TPD programmes that centre around these pedagogies should be highly supportive and collaborative to overcome these challenges for positive change.

1.3 Supporting teachers to utilise ICT for learning

1.3.1 ICT for education

As well as being used as a medium for teachers to access TPD, digital technologies are being employed in schools to enhance the quality of lessons, reduce learning disparities, and help learners to develop 21st century skills required when joining the workforce (UNESCO, 2014; World Bank, 2018; Bestwick & Campbell, 2010). Numerous technology projects and initiatives organised by large donors, policy-makers, NGOs and other key stakeholders have been implemented which aim to support teaching and learning in primary and secondary schools in SSA (Hennessy et al., 2010). Smartphones and tablets, with their potential to provide cheap and quick digital content, have become especially popular in educational contexts within both the global North and South (Herselman & Botha, 2014; Haßler; 2015).

ICT-related initiatives are often extremely complex, and earlier programmes overlooked the intricacies of both the human side of integration (e.g. teachers, on-going support, trainers, and headmasters) and the technological side of it (e.g. hardware, software, infrastructure, technical support: Abuhmaid, 2011). For example, the 'One Laptop Per Child' (OLPC) initiative distributed over 200,000 low-cost, education-oriented PCs worldwide in its belief that it could "transform education for the world's disadvantaged schoolchildren by giving them the means to teach themselves and each other" (Kraemer et al., 2009, p.66). However, evaluations demonstrated it had no impact on raising students' numeracy and literacy skills due to: a lack of understanding of the local environments, the need for on-going appropriate and costly infrastructure and the absence of complementary support to the technology (De Melo, 2014).

Research has shown that this techno-centric view is a fallacy: "the mere introduction of technology in schools does not in itself change anything" (Rubagiza et al., 2011). Additionally, there is general concurrence that technologies which aim to complement teachers' work, are far more fruitful than those which substitute for them (Hennessy, 2010a; Burns et al, 2015, World Bank, 2018). This has led to a refocus on teachers as integral components to any successful educational intervention (Abuhmaid, 2011, p.15).

1.3.2 Software, hardware and infrastructure

Whilst teachers remain central in many ICT programmes, introducing technology is also heavily dictated by the accessibility of the available software, hardware and infrastructure of the school (Hennessy, 2010). Although several countries have recently introduced large-scale technology implementation schemes, many of these have been delayed or even abandoned due to excessive breakages, a lack of Wi-Fi and technical infrastructure, inappropriate educational content, and unforeseen costs (Clarke & Svanaes, 2015). For example, in Uganda, the overwhelming majority of schools lack access to both power and the internet which makes it difficult for certain types of ICT to penetrate the schooling systems (Yonazi et al., 2012). This illustrates the demand for schemes to consider and/or modify the individual local and schooling provisions and infrastructure before providing technology.

In SSA, there is a high variability of these elements between urban and rural schools – in Rwanda, urban schools have relatively more computers, internet connectivity and ICT equipment than rural schools (Rubagiza et al., 2011). Unfortunately, these discrepancies may be leading to an even greater 'digital divide'[3] and thereby social disparity between these areas (Fuchs & Horak, 2008). Therefore, there is an even stronger need for rural schools to be targeted and for new technologies designed to suit these types of contexts. Local servers could be a suitable solution to the lack of connectivity in rural areas. For instance, 'Aptus', designed by the Commonwealth of Learning, allows the learner to connect to a digital learning platform and access course materials without the need for internet access (Ally et al., 2017).

Hardware such as iPads and computer labs in schools can be costly. Yet the proliferation of mobile phones in SSA has meant that there is opportunity to cheaply harness devices that teachers and students already own (Yonazi et al., 2012). Moreover, there are huge growths in the manufacturing market for low-cost, low-energy tablets and multi-functional tablets (Haßler et al. 2015). These can be

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[3] A global disparity of unequal access to digital technology and information (Tate, 2017).

used in a realistic model of shared access between students: "These devices can be moved around within schools, and can therefore be more easily integrated into classroom teaching" (ibid, p.10).

The type of software that is provided on these devices is also paramount: "there is little point in introducing computers into educational establishments across Africa unless there is appropriate content that they can bring alive" (Unwin, 2005, p.120-121). Open Educational Resources (OER) initiatives, for instance, produce free, high quality resources accessible to anyone to use enabled by ICT devices. Through these, educators are exposed to what colleagues are doing and can download content to localise for their own use. Yet it is also important to ensure that content is context-dependent i.e. provides literature that is culturally-appropriate and in the local language and ideally with links to the relevant curriculum and examinations (Unwin, 2005).

2.3.3 Supporting teachers with ICT

However, even if teachers are provided with suitable software, hardware and infrastructure, it does not necessarily result in adequate use of technology for learning. Hennessy et al. (2010) argues teachers' attitudes, expertise, lack of autonomy or technophobia can be other factors that hinder their confidence and readiness to use supporting ICT within the classroom.

These obstacles point heavily to the requirement of appropriate, sustained TPD to support teachers in this area. A range of programmes exist that focus on different areas: improving teachers' ICT skills, including word-processing, spreadsheets, and surfing the Internet; training teachers and students to use technology effectively in the classroom; training teachers to use modern pedagogies and integrate them with ICT (Yonazi et al., 2012; Abuhmaid, 2011). Positive outcomes are also dependent on on-going technical support for teachers. Equipment will undoubtedly need maintaining and expectedly, teachers will encounter a range of challenges (Clarke & Svanaes, 2015; Haßler, Major & Hennessy, 2015). Importantly, the school culture must not only be supportive of teachers' TPD and experimentation, but also ensure that there are established systems so teachers have fair access to the equipment and are strongly encouraged to use and experiment with it (Abuhmaid, 2011; Unwin, 2005). If technology remains an object of fear, uncertainty or mystery, only used for special occasions, they are unlikely to be fully exploited and used effectively. Thus, all technology must become part of the "panoply of tools" that teachers have regular access to enhance their students' learning (Unwin, 2005, p.119).

2.3.4 ICT Potentials Inside and Outside the Classroom

Digital technology can offer new ways of presenting or explaining ideas and concepts. For example, videos, animations, pictures and podcasts, provide new visual and aural learning tools for students to

learn from. Ruchter et al. (2010) found that technology can provide students with environmental learning experiences that may be inaccessible to them. Using the computer as a mobile-guide, participants were able to access and discover the River Rhine through a virtual environment.

In Pakistan, teachers and students were introduced to new course resources through the Aptus offline local server (Ally et al., 2017). When using the resources in class, teachers felt that students were more attentive, motivated and interested in the lessons. Students corroborated this and voiced that they felt they learnt faster and more easily. Teachers felt that a 'blended approach' of the tablets was the most effective: a mixture of independent study and teacher directed classes (Ally et al., 2017). This meant that as well as interacting and learning pedagogically with the devices, students were independently able to access the content on the devices outside the classroom, improving their research skills and becoming autonomous in their own learning – essential competencies in the current technological era (ibid.)

However, the inclusion of technology within lessons can often be time-consuming. They require a lot of preparation time and technical issues can result in wasted time in the lesson. This is not helped by rigid curricula which leave little time for innovative classroom practices (Hennessy, 2010). Therefore, establishing both a policy environment and school environment that take account of this ICT integration would be ideal (Yonazi et al., 2012).

Summary

The use of ICT in educational contexts offers a range of exciting potentials and benefits for student learning. Yet, the need for appropriate hardware, software, infrastructure and education is essential to ensure that technology is fully exploited and does not fall into an unusable, unused or broken state. Teachers need to be supported in how to engage and utilise the equipment and, as technical difficulties are expected, there needs to a framework of support in place. The technology can be used inside and outside the classroom to introduce novel ways to learn, teach and engage students – and should always be used as a complement to face-to-face teaching.

Conclusion

The areas of TPD, interactive pedagogy and technology can be combined to potentially offer an effective and scalable programme that can raise "teacher quality" and thereby student educational outcomes (Figure 2 below). For successful and sustainable execution, the design principles and on-going management of TPD programmes are essential to increase effectivity, teacher motivation and to mitigate arising challenges. Research has demonstrated the strength of interactive pedagogies within the classroom to enhance student learning, it also illustrates the need for sensitive and considered TPD

programmes as a medium for its implementation. Similarly, the use of ICT in educational contexts requires TPD to ensure adequate teacher and student exploitation of devices for educational gains.

Yet, it is also highly favourable to include the facets of interactive pedagogy and ICT *within* TPD programmes to promote teachers as 'reflective practitioners' and also to achieve cost-effective, scalable, and accessible programmes. The TPD sessions themselves should be based on interactive pedagogies so teachers receive the benefits of these methods, and also a model for their own teaching. Moreover, ICT devices can be utilised as a medium to allow greater accessibility of TPD resources in rural contexts as well as being used as a resource on its own.
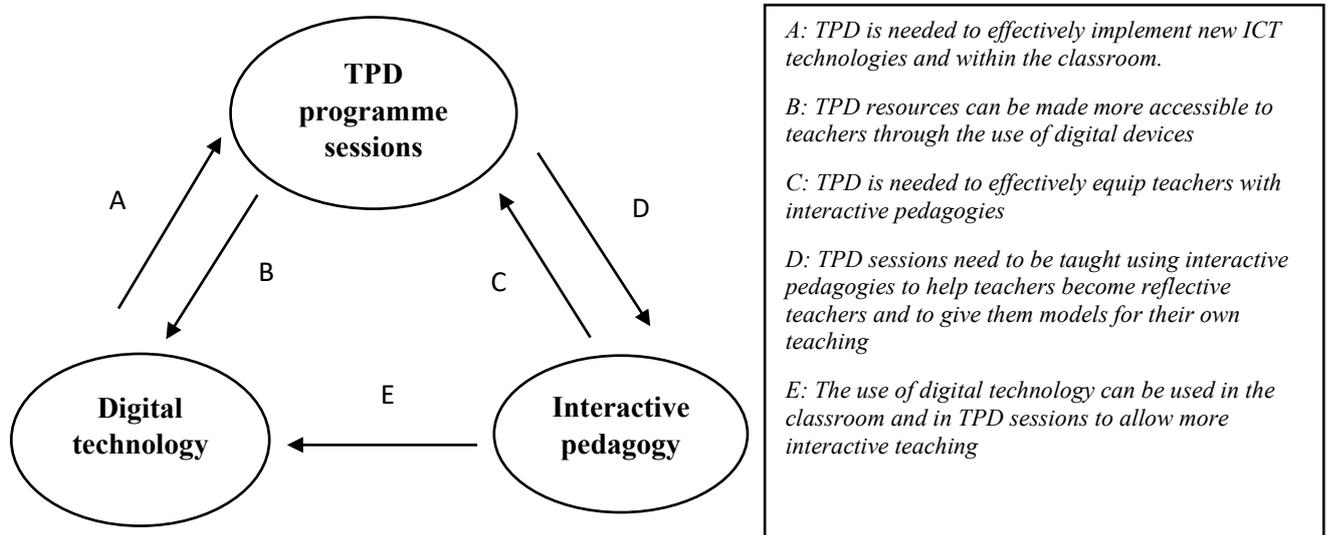
Figure 2: How the areas of TPD programme sessions, digital technology and interactive pedagogy can interact to provide an effective TPD programme.

CHAPTER 2: Mpumelelo High School context and OER4schools

This chapter begins by exploring the specific background of Zimbabwean rural secondary schools and the need for TPD. The context of Mpumelelo High School is described in terms of location, donor input and technical infrastructure, hardware and software. OER4schools is placed against the backdrop of the literature review of the previous chapter to highlight key characteristics that were considered fundamental for TPD success. The final section describes the timeframe and structural implementation of OER4schools at Mpumelelo.

2.1 Zimbabwe and rural secondary schools

Across SSA, the demand and access to secondary schools is growing as is the increased pressure on the education systems to find creative ways to manage the discrepancy between the teacher demands versus supply (Nakabugo et al., 2018; Bainton et al., 2016). In Zimbabwe, the education systems in rural communities, marked by unreliable transport and a lack of resources and physical infrastructures, are far behind the rest of the country and teacher motivation is extremely low (Mukeredzi, 2013; Nyachowe, 2018). The recruitment and retention of high quality teachers is a critically pronounced struggle in these areas as proficient teachers often reject and avoid rural posts due to geographical isolation and socioeconomic circumstances, with the perspective that "teaching in rural schools is seen as second-grade" (Mykeredzi & Nyachowe, 2018, p. 2; Arnold et al., 2005).

Mukeredzi (2013), in her study of rural secondary schools in Zimbabwe, therefore argues that there are both opportunities and major needs to enhance the development of strategies that promote teacher learning in rural contexts. This is seconded by Nakabugo et al., (2018) who contends that TPD "is a very promising area of policy and program intervention in improving the recruitment, retention, and retraining of secondary teachers" (p.178). The increased enrolment of students places greater pressure on teachers as they are faced with bigger class sizes and students who have even more disparate needs[4]: secondary school "teachers would need to be supported now, more than ever before" (ibid., p.178).

2.2 Mpumelelo High School, Nkayi

Mpumelelo High School is a mixed secondary school in the rural area of Nkayi in the region of Matabeleland North, Zimbabwe (see Figures 3 & 4). It is located 168km northeast of Bulawayo, Zimbabwe's second biggest city. The school has a total enrolment of 543 students and accommodates

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[4] The increased enrolment has attracted students who may have different characteristics than they did in the past – i.e. they may have inadequate mastery of language of instruction and numeracy and rudimentary scientific thinking (Nakabugo et al., 2018)

students from lower-secondary school to sixth form. It follows the typical Zimbabwean secondary school system based on the Cambridge 3-tier model and, like many SSA secondary schools, uses English as the medium of education. The first language for the majority of teachers and students is Ndebele, and many are also fluent in Shona, Zimbabwe's other official language.

From 2014, the school has been involved with various national and international donors including School for Teacher Education, University of Applied Science in Switzerland and World Vision Zimbabwe. These collaborations have been instrumental in giving the school access to technology (hardware and software) and developing the required infrastructure. These resources include: a computer lab, staff tablets, shared student tablets (15 per department); solar-powered energy base; a Wi-Fi connection; access to a RACHEL (Remote Area Community Hotspot for Education and Learning) server which provides a library of educational digital content through a local offline connection.

2.3 OER4schools

OER4schools is an Open Educational Resource developed to support teachers in SSA contexts to implement interactive methods of teaching to focus on deep student learning and understanding (http://www.oer4schools.org/). This TPD programme was initially developed through a North-South partnership between a Cambridge team and Zambian institutions. The resource consists of 28 two-hour sessions organised in 5 units: interactive teaching principles and the use of ICT, group work, questioning, dialogue, Assessment for Learning, and enquiry-based learning. This programme also exploits the use of mobile technologies so schools can gain access to these materials, and also for teachers to use these technologies to enhance their practice.

The resources are founded on principles of effective pedagogy of teaching and learning in SSA and are freely accessible as an OER. Each session has both a version for the 'facilitators' for teacher-led sessions, and for 'participants' or teachers to engage in the sessions. Each resource is clearly structured with learning objectives, and activities and tasks that focus on support teachers with interactive and ICT components to improve teaching quality.

Conceptual and theoretical underpinnings of the programme are grounded in teacher learning as situated and social (Hennessy et al., 2016). Therefore, practices consistent with social constructivist approaches are prioritised: small-group, pair and whole-class interactive work, extended dialogue with individuals, higher order questioning, teacher modelling, reciprocal teaching and co-operative learning. Teachers are encouraged to accept a more democratic and less authoritative role to offer skilful supported instruction to students (Westbrook et al., 2013).

Moreover, the TPD sessions strongly focus on aspects of shared teacher reflection and critical inquiry. These are promoted through sustained models of professional learning communities whereby an environment is created encouraging peer dialogue and collaborative learning (Haßler et al., 2014). Filmed exemplars of interactive practices in Zambian and South African classrooms are used within the TPD resources as stimuli for critical inquiry and to focus teachers' attention on the students and their learning. This equally relies on the premise that if teachers are to use interactive methods within their practice, TPD programmes must use advocate and model equivalent methods (Leu & Price-Rom, 2006; Haßler et al., 2014).

2.4 OER4schools at Mpumelelo

In Zambian primary schools (2010-2014), the use of OER4schools resources within a weekly- led sessions resulted in teachers' trialling new pedagogic strategies which had a positive impact on their learners. Following this implementation, the headteacher of Mpumelelo collaborated with OER4schools to set up a similar structured programme to utilise adapted resources in a different context and schooling stage (see Appendix A for a sample of the adapted OER4schools resources).

In November 2017, the four teachers were selected as 'Facilitators', and met weekly to work through 5 units. In 2018, eleven more teachers were selected to be 'Pioneer' teachers as a secondary support team, and attended weekly sessions guided by the Facilitators in the same pedagogical theories and practical implementation. At the start of 2019, the rest of the Mpumelelo teachers began to attend weekly sessions on the OER content and resources: these were peer-led by the Facilitators, and the Pioneer teachers were at hand to assist. At this point, all teachers had access to their own personal tablets to use within these sessions and for their teaching.

Lulu Lumbiwe, an external experienced TPD facilitator, was present to help the Facilitator teachers lead the first 5 TPD sessions which took place consecutively a week before term started in January 2019. She was also joined by Roland Diethelm, a technical expert, who was on hand to assist with all technology issues that arose. After these sessions, the programme was peer-led by Facilitators in weekly slots: Wednesday afternoons from 2-4pm were allocated by the headteacher as the designated timing.

Although R. Diethelm and L. Lumbiwe were not present in Nkayi for the remainder of the programme, through the use of a Whatsapp group chat with the Facilitators and other external members of the team, (Urs Grobriel & Bjoern Haßler) there was continued provision and monitoring of the TPD sessions. Using this line of communication, the Facilitators report back how each weekly session went (often through photos), explain any difficulties they faced and questions that they have.

The external team consequently aim to support the teachers by ensuring sessions are running smoothly and all issues (technical or otherwise) are resolved.

Figure 3: Mpumelelo High School building containing classrooms and teacher staffroom

Figure 4: Onsite shared teacher accommodation

CHAPTER 3: Research Methods

This chapter seeks to provide a detailed description of the research methods and methodology employed to address the research questions (Section 3.1 below). First, the research approach and framework is explored and endorsed by the study's aims and context. The fieldwork trips are outlined, and subsequent data collection techniques are described in detail to discuss their appropriateness, strengths and limitations within this particular context. Vital areas of validity, reliability and trustworthiness are integrated throughout the discussion to demonstrate awareness of biases, issues and the subsequent attempts to mitigate these. Researcher positionality, ethics and informed consent are considered to examine factors that may emerge specifically within cross-cultural research. Finally, the data analysis tools are described to suitably inform how the findings in the following chapter were reached in a methodological and trustworthiness manner.

3.1 Aims and Research Questions

The research conducted for this project sought to examine:

What do secondary school teachers' perceptions and practice reveal about the outcomes of a TPD programme for interactive teaching and technology use in rural Zimbabwe?

The specific research questions I used to guide my primary data collection were:

RQ 1: What are the emerging themes from the teachers'/headteacher's perspectives on the TPD?

RQ 2: What are teachers' perceptions on the use of interactive pedagogy within their lessons? How is this pedagogy reflected in their practice?

RQ 3: What are teachers' perceptions on the use of technology within their lessons? How is this reflected in their practice?

RQ.4: Are there any significant differences in snapshot lesson 'interactivity indicators' (see section 3.6) taught by teachers in the different TPD exposure groups (Facilitators, Pioneers, teachers)?

3.2 Constructivist Case Study Approach

A case study approach was used to collect my primary data due to my research questions that "aim to explore and depict a setting with a view to advancing understanding" (Cousin, 2005, p.421). This type of research excels at sharpening perception of a complex issue, adding strength to what is known by previous research, and emphasising a detailed contextual background of specific events or

conditions (Grauer, 2012). As I explored a TPD programme within a particular contextual setting, whilst also using a literature review to place these findings within similar international research, I felt this aptly suited my research aims. The holistic view that a case study can provide is typified through depth of content, circumstance and 'thick description' (Njie & Asimiran, 2014; Cousin, 2005). Especially when analysing educational settings, this is essential to encapsulate the vividness of a classroom environment with its numerous interactions, responses and activities; the case study research should meticulously be building a picture of the 'case' (Cousin, 2005).

This approach was also informed by constructivist grounded theory in its nature of discovery, representation of viewpoints and construction of knowledge, and focus on depth and nuance of accounts. My data collection methods seek to understand and describe human nature by unearthing teachers' responses in relation to a TPD programme. Moreover, as I chose to represent multiple viewpoints of the same occurrence, it reflects the constructivist assumption that people may construct or co-create meaning in different ways, even in relation to the same phenomenon (Crotty, 1998, p.9). This also relates to the acknowledgement of the stance of researchers who "construct our grounded theories through our past and present involvements and interactions with people, perspectives and the research practices" (Charmaz, 2006, p.10; Lauckner, et al., 2012): i.e. my experiences 1) as a secondary school teacher, 2) in similar contextual settings and 3) engaging with research, will have strongly influenced my perceptions. Finally, as the constructivist paradigm aims to discover the features required to understand a specific context (Taber, 2013), it allows for greater in-depth and nuanced investigation of an experience. I similarly aim to appreciate the TPD programme through engagement with many dimensions of its contextual setting.

3.3 Outline of fieldwork trips to Zimbabwe

My data collection for this project spanned two trips to Mpumelelo High School in Nkayi. The first visit was for two weeks in January 2019 during the final two weeks of school holidays. On this trip, an external and experienced TPD facilitator and an experienced IT technician were at Mpumelelo to deliver a face-to-face two-week TPD workshop. In the first week, there were sessions on implementing and handling ICT devices, and in the second week integrated OER4schools materials were used. During these workshops, I was able to observe and take unstructured qualitative notes. In the second week of the programme, school term was expected to begin and teachers would be attending the TPD sessions in the morning and experimenting with new pedagogical practices in their classes the same afternoons. However, due to Zimbabwe's volatile political situation and hyperinflation, a national teaching strike was established as teachers campaigned for their salaries to be paid in US dollars. Unfortunately, the situation worsened, and the last two sessions of the TPD

programme were cancelled as it was considered too dangerous for teachers to be seen to be going to school.

My second visit was in the final two weeks of March 2019 during the school term. Following the previous political situation, the teacher unions were in dialogue with the government about teaching salaries and an arrangement was thought to be reached. In the meantime, teachers had returned back to teaching their classes following a teacher strike of over a month. Though behind schedule, the 'facilitator teachers' were back to running the weekly TPD programmes as had been agreed. During this visit, I was able to conduct unstructured observation of two of these TPD sessions using OER4schools resources. Additionally, I observed 12 teachers' lessons and interviewed these same 12 teachers. I also conducted an interview with the headteacher of the school.

3.4 Data collection

3.4.1 Triangulation approach

Table 1: Overview of all data collection methods: the types, quantity and timings, and foci

Method (data type)	Quantity/ timing	Focus
Audio recorded semi-structured interviews with teachers (transcripts)	12 individual teacher interviews (See Appendix C for questions)	Participants' experiences and perceptions of the TPD programme: successes, challenges and impacts of the TPD on classroom practice and student learning
Audio recorded semi-structured interviews with head- teacher (transcript)	1 headteacher interview (See Appendix D for questions)	Background of the TPD programme; successes and challenges; perceived impact on teachers' practice and attitudes
Videoed lesson observations	12 teachers were observed, 1 lesson per teacher.	Capturing the presence and range of interactive pedagogies and techniques used; how technology was used and managed
Unstructured observations of TPD sessions	5 sessions in January (led by external professional facilitator) 2 sessions in March (peer-led by 'facilitator' teachers)	Any significant details, opinions or dialogue between the teachers

When examining the teachers' pedagogy in relation to the TPD programme, Alexander's (2009) definition of pedagogy proved essential: "pedagogy is the discourse with which one needs to engage in order both to teach intelligently and make sense of teaching - for discourse and act are interdependent, and there can be no teaching without pedagogy or pedagogy without teaching" (p.4). This highlights the imperative to gather teacher perspectives through interviews, alongside observations of lessons, to view 'real-life' naturalistic examples of teaching.

Hence, a triangulation of methods was used to capture both discourse and act (see Table 1 above). This approach allows comparison of data sources to determine corroboration and qualitative cross-checking to establish a stronger validity of results and enable a multi-layered perspective of data (Briggs et al, 2012). As each data collection tool has its inherent flaws, a combination of tools measuring the same construct should result in an averaging out of deficiencies to produce a truer result and understanding of the situation. (Cotton et al., 2010; Briggs et al., 2012.)

3.4.2 Sampling Selection

A vital aspect of any research is the sampling size and methods of sampling selection due to its profound effect on the quality of the evidence (Mills et al., 2010). Especially in qualitative research, inquiry generally focuses on the depth of relatively small sample sizes selected purposefully for information-rich cases (Patton, 1990).

For this study, I wanted my sample size to give an accurate representation of all the teachers at Mpumelelo to produce a form of generalisation, despite the singularity of the case (Cousin, 2005). Therefore, out of the 26 teachers at the school, I decided to choose 12 teachers to focus on. Four teachers were selected from each grouping - Facilitators, Pioneers, other teachers - who had received different levels of exposure to the TPD programme. Apart from the facilitator group, where there were only four teachers in total so all participated, the teachers from the Pioneer and other teacher group were initially selected randomly. This is an application of Patton's (1990) 'Stratified Purposeful Sampling' whereby different cases who have had varying exposures to the independent variable are selected. Certain advantages of this particular technique include the highlighting of individual characteristics of the subgroups of interest, the facilitation of comparisons between these subgroups, and the identification of an overall common core of data (ibid.). These were facets ideal to my desire to explore depth and contrasts of each particular grouping, as well as to produce overall insights.

However, my plan to randomly select teachers from the pioneer and teacher group was quickly forfeited: when I arrived at the school over a third of the teachers were away for the first week on an external sports trip. Consequently, I had to adjust the selection of the teachers in these groups to availability rather than use a systematic method.

3.4.3 Lesson Observations

When examining pedagogy, the need to receive first-hand experience of the processes and interactions that take place in the classroom is indispensable (Alexander, 2014; Westbrook, 2013). Cotton et al. (2010) argue that observations have the advantage of collecting data from events which occur in real-time, naturalistic settings, rather than in more artificial contexts. As such, they have the potential advantage of being more free from bias and less influenced by the researchers' own agenda (ibid.).

In my data collection, each of the 12 teachers was observed and video-taped with a camera and tripod for one lesson (the average length of these recorded lessons was 20:32). The foci of these observations were teachers' use of interactive practices and use of ICT (see system in 'Data Analysis' below). Also, key lesson events and details were noted – i.e. subject, class size, learning objectives. During these observations I encountered various difficulties with the filming equipment. In some classes, the camera lens was not wide enough to capture the whole classroom and it was difficult to quickly move the camera to different students as they responded to teacher questioning. This meant the contributions of some students were not visually portrayed, though they could be audibly heard.

This recorded medium of the observation was fundamental to the subsequent Stimulated Recall Interviews (SRI) and also effectively provided an accurate documentation of the lessons to allow the data to be "viewed, analysed and re-analysed in-depth from multiple perspectives at a later date" (Baker & Lee, 2011, p.1437). Videoing classroom observations is additionally recommended as the more detailed record of events may reduce the impact of prior observer biases (Cotton et al., 2010).

However, especially in classrooms, there is a risk of 'reactivity' to a recording device which may result in participants acting differently when being observed (Cotton et al., 2010). Evidently, this can be a threat to both the reliability and validity of the data; for example, if searching for regular patterns, behaviours or typical events in the classroom, reactivity may distort this (Baker & Lee, 2011). As I only had two weeks at the school, I was restricted with the number of lessons I observed per teacher. Consequently, I was particularly vulnerable to these types of drawbacks as I could not gradually get the students and teachers acclimatised to the recording equipment, or look at the teachers' pedagogies using a range of lesson observations (Baker & Lee, 2011). I aimed to mitigate these biases by organising with the teacher on the morning of the observation which lesson they would be happy for me to observe with the assumption that the teacher would not have much time to heavily prepare the lesson and therefore deviate from usual practice. Moreover, I was very careful to frame these singular lessons as 'snapshots', rather than assume they were representative of the teachers' general practice.

3.4.4 SRI and Semi-Structured Interviews

Interviews are intrinsic strategies in gathering participants' experiences, views and beliefs on a certain phenomenon, and thus obligatory tools required for my research questions (Ryan et al., 2009). These interviews were carried out with the teachers and headteacher to include the perspectives of stakeholders at distinct levels of the TPD programme – "an ideal in qualitative research" (Creswell, 2013, p.157).

The teacher interviews used a combination of Stimulated Recall Interview (SRI) focused questions followed by a series of semi-structured questions (see Appendix C & D for interview questions). SRIs are a type of retrospective verbal report in which participants receive a prompt or stimulus – such as an audio, video, or transcript – to use to recount their cognitions (Baker & Lee, 2011; Lyle, 2002). These are highly effective vehicles for combining interviews and observations to examine the thought-processes, knowledge bases and degree of reflectiveness of teachers (Calderhead, 1981). In addition, they allow greater contextualisation of a classroom scene through the added teacher perspective to verbalise deliberate and non-deliberate behaviour and decisions (Lyle, 2002).

In my research, SRI were used to examine teachers' thought processes and knowledge bases at particular parts of interactivity or non-interactivity within their lessons[5]. When observing the lessons and re-watching the videos, I would come up with lesson specific questions on 3-4 lesson instances or teacher moves that I wanted to discuss with the teacher in more depth. For example, when a teacher implemented teaching moves such as 'randomly selecting students for questioning', 'code switching' or 'group-work', I wanted to capture whether this was an intentional move, the teachers' reasoning behind it, and what impact they thought this had on student learning. Therefore, before the interviews, the teachers and I would watch the significant lesson so they had these moments clear in their minds to better answer these questions. Moreover, the stimulus was used to facilitate the teachers' thoughts on the overall strengths and challenges of their lesson, and what they might change if they were to teach the lesson again.

However, there can be huge limitations with this type of interview. Lyle (2002) argues that "the main concern is the extent to which the subjects have reordered their thoughts before or during the recall process" (p.872): i.e. participants may censor or distort their thoughts to present themselves more favourably or add knowledge to possibly provide inaccurate reasons for their actions (Fox-Turnbull, 2011). These issues can be propagated by the duration of time between recorded activity and

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[5] To facilitate the later transcription of these interviews, an audio recording device was used to capture the conversations – these were of generally good quality.

participant reflection (Calderhead, 1981). In order to avoid and alleviate these pitfalls of SRI, I attempted to use the recommendations of memory retrieval, timings and instructions poised by previous research and literature. Firstly, I ensured that the SRIs were carried out as soon as possible after the observation to increase the likelihood of it being a recall or direct report of the experience (Fox-Turnbull, 2011). Moreover, to relieve anxiety in the teachers, I reassured them that both the observation and interview were not an assessment of any form (Baker & Lee, 2011).

The subsequent semi-structured interviews were used to understand the head teacher's and teachers' general perceptions of the TPD programme: benefits, highlights and challenges and try to prompt teachers to give past accounts of times when they used interactive methods and technology within the classroom. I chose this format due to my choice of open-ended questions and to allow the interviewees to have heightened control over the process, so they could 'tell their own story' and allow for interview and interviewee dialogue (Ryan et al., 2009). This was especially important when teachers were asked to give specific examples from their practice as I could encourage them to add more detail and depths of these accounts to justify whether I felt these examples were 'concrete' enough[6].

The influence of 'interviewer effects' was also seriously considered, such as: participant social desirability, interviewer leading questions and implicit gender, race or power structures (Opdenakker, 2006). Jakobsen (2012) argues that what a participant says will be largely a function of the impression they want to give the interviewer. For example, if teachers feel that their responses may make them appear less competent or is inconsistent with expectations, a self-presentation bias may shadow the results (Kopcha & Sullivan, 2007). Bober et al., (1985), for instance, considered this type of bias as the possible cause of the emergent discrepancy between teachers' self-reports of their use of educational technology practices and their students' reports. As the use of educational technology was seen as a desirable classroom practice, the teachers portrayed themselves in an overly positive manner in comparison to their colleagues (ibid).

I therefore made efforts to reduce these compromising effects and biases. Due to the high possibility of social desirability bias on self-report data, I opted for a stronger approach by collecting and analysing four different data sets (Table 1) to corroborate more accurate findings (Kopcha & Sullivan, 2007). Moreover, after attending a session at my University on conducting interviews prior to the data

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[6] It was essential to assess whether the examples teachers provided of classroom practice were actual incidents or simply their talk about pedagogic ideas (Hennessy, 2015). Revealing signs of tangible or 'concrete' events were examples that provided specific description, names, and something that changed when the teaching method was implemented. This consideration is also discussed in Table 4 'Trustworthiness Strategies.'

collection, I became aware of the influence of my body language, types of questioning and spatial elements and thus tried to manage these in a manner so the participants would feel at ease.

3.4.5 Unstructured TPD observations

I was able to attend TPD sessions that were led by R. Diethelm and L. Lumbiwe and the teachers themselves. For these environments, I decided that unstructured observations would be the best way to collect data.   This is because, rather than being constrained by checklists or coding schemes, I wanted to holistically investigate these sessions and explore events, contributions and nuances that were deemed significant to my research questions (Given, 2008).

The flexible style of unstructured observations permitted detailed collection of a range of data: TPD session structure and content covered, verbatim or paraphrased contributions from the teaching staff/facilitators, and comments about any interesting events, absences or reactions (verbal or paralinguistic). Moreover, Mulhall (2003) reasons that within unstructured observations, the researcher may fluidly switch between the roles of participant to observer. This was essential, as I felt it was beneficial to my understanding of the TPD to participate in the pair and group activities alongside the teachers.

A major weakness of this form of observation is its susceptibility to observer bias - results depend on the investigators' skills and experience, what they choose to observe and how they process and analyse that information (Given, 2008). However, by triangulating these TPD observations with both interviews and lesson observations, the data were used to corroborate and add depth to teachers' perceptions and practice but not as an isolated data source itself.

3.5 Cross-cultural research considerations

Undeniably, in any research undertaking, there are always going to be forms of bias present and collisions of values, practice and intentions; "yet, we tend to expect more of these tensions when working across contrasting cultures and languages" (Robinson-Pant & Singal, 2013, p.443). A few of these biases - and correlating mitigating attempts - have been discussed above in the form of: personal biases of the researcher, reactivity to the observer and equipment and interviewer effects (Opdenakker, 2006; Given, 2008; Cotton et al., 2010). However, when a researcher explores an unfamiliar cultural context, new conflicts may arise and typical ones may be exacerbated. It is therefore vital within cross-cultural research to demonstrate an awareness of one's own positioning to minimise compromising validity and reliability, and establish relevant ethical guidelines.

3.5.1 Researcher positionality

A researcher's identity, and how they are situated or situate themselves within or against a different cultural backdrop, can be highly significant to the collection and analysis of data. McNess et al. (2013) argue against the appropriateness of dualisms – researcher/researched and insider/outsider – in the recognition of the social constructivist version of identity which can be fluid, fragmented, incomplete and constantly shifting. For example, as a Western researcher and seen as a *mzungu*, Milligan (2014) attempted to renegotiate her position in rural Kenya and the implicit power and privilege structures that could be a detriment to her data. She felt that by using more participatory methods and building relationships within the community allowed her to collect more "authentic portrayals" within her research (p.249).

I felt that these were critical ideologies to consider in my research project in rural Zimbabwe. Therefore, I was keen to similarly cultivate reciprocal relationships to break down possible power structures and barriers with the school community. I attempted to immerse myself within the teaching and schooling community, absorb information about the local cultural and traditions of the rural community, and learn from teachers about their individual backgrounds and daily lives. Due to my experience as an English secondary school teacher, I was able to discuss the professional challenges that I faced, which were often shared by and commiserated with the Zimbabwean teachers. I felt that the teachers' respected me due to my experience as a teacher, which later resulted in the teachers feeling more comfortable with my role as observer/interviewer and consequently answered my questions with greater veracity. Moreover, the constant informal conversations with the teachers deepened and contextualised my understanding and thus data with surrounding local circumstance and history.

3.5.2 Ethics and informed consent

Another serious consideration includes the ethical principles and dilemmas that underpin a research project in cross-cultural research. Ethics are crucial in all types of research in the forms of participant informed consent, anonymity within data, data collection that is accurate and vetted for biases, and the researchers' responsibility concerning the dissemination of the research (Robinson-Pant & Singal, 2013; Tikly & Bond, 2013). Therefore, before data collection, I submitted an ethics and risk assessment to the University of Cambridge outlining my code of practice and steps towards ethical clearance (see Appendix B).

In addition, the headteacher and teachers all provided written and verbal informed consent before any observations and interviews were conducted. This was in accordance with the BERA Ethical Guidelines for Educational Research (2011) so included clear 'Openness and Disclosure' of the

research aims and explicated to participants their 'Right to Withdraw' at any time. My research aim and purposes were explained to the teachers by the headteacher in Ndebele (the local language) to ensure clarity, and I discussed these individually with the teachers in English prior to their observations and interviews. Many of the teachers requested a copy of their personal video and interview audio recordings which demonstrates the research transparency. Furthermore, all the names provided in this project are pseudonyms to guarantee teacher confidentiality (BERA, 2011). Proper consent has also been obtained for all the included photos where teachers are identifiable; student faces have been blurred (using editing software Pixlr.com) to protect their identity.

Yet, being a Western researcher in non-Western contexts can raise other important ethical concerns. Tikly & Bond (2013) explore the 'post-colonial condition' whereby in these contexts, the residual of unequal power relationships result in Western impositions of research concerns and agendas. A possible solution to these tensions is to accommodate a 'hybridity' in ethical practices when in varied research environments (Shamim & Qureshi, 2013). This can be achieved through an inter-cultural ethical dialogue between the North and the South to develop locally contextualised guidelines built on "trust, care, human dignity and social justice" (Tikly & Bond, 2013, p.26).

To ensure the feasibility and strong ethical guidelines of my proposed data collection, I was in regular contact with the headteacher prior to my second trip to establish research practicalities and include any concerns or adjustments she may have had to my methods. This communication was absolutely fundamental to ensure the smooth conduct of my research when at Mpumelelo. Yet beyond this, it was a sign of respect and a move towards a cross-cultural dialogue to include and collaborate with a key local stakeholder to establish joint control over the direction of the research (Tikly & Bond, 2013).

Further amalgamations of ethical procedures can be viewed through the need for student consent. Due to my chosen research methods, students, as well as the teachers, were evidently videoed in the observation lessons. I decided in conformity with U.K. education standards that I wanted to inform the students' parents of my research to give them the opportunity to opt in or out, as well as the students themselves. My supervisor explained that in the Zambian context of her research study, a feasible way to gain parental consent had been to invite the parents to a meeting where the research aims were discussed, they would have the opportunity to ask questions in their local language and to then decide whether to provide consent on behalf of their children However, appropriate ethical approaches are always culturally situated and upon arriving at the school, the headteacher said that a meeting would not be an appropriate medium in the school context. She said that the teachers and herself were the guardians of the students, so would give consent on their behalf. A compromise was therefore reached that the students would be given an explanation of my research prior to the recorded

lesson with the chance to opt out of the video recording. As these students were of secondary-school age, I deemed them capable of determining their own decision in conformity with the BERA standards: "children who are capable of forming their own views should be granted the right to express their views freely in all matters affecting them, commensurate with their age and maturity" (2011, p.6).

3.6 Data analysis

3.6.1 Interview coding: Accounts, impacts and challenges of the TPD programme

The headteacher interview and twelve teacher interviews were transcribed in full and carefully examined using thematic analysis coding. This method was selected due to its flexibility of application to many types of data sets and its potential to yield a "rich and detailed, yet complex account of data" (Braun & Clarke, 2006, p.5). Moreover, this method is useful when exploring the perspectives of different research participants as it distinguishes both similarities and differences and highlights unanticipated discoveries (Nowell et al., 2007).   However, as it is a complex process and there is no clear agreement in literature on how researchers can rigorously apply the method, researchers must be transparent and provide a detailed description of how the analyses were conducted (Nowell et al., 2007).

I chose to use Braun and Clarke's (2006) six-stage "recursive process" to guide my thematic analysis due to its clarity and rigour of analysis. The six steps include: 1) Familiarising yourself with your data; 2) Generating initial codes 3) Searching for themes; 4) Reviewing themes; 5) Defining and naming themes; 6) Producing and writing the report.

The interviews were transcribed using key symbols from Jefferson's Notation (1984) to account for overlapping speech, pauses, non-verbal activity and unclear speech (see Appendix E for a sample transcript). After I had transcribed the interviews, I re-read the transcripts to familiarise myself with the data and attempted to note down emerging themes. I also reviewed the interview questions and notes I had made whilst in Zimbabwe to prompt my memory of any patterns I had initially noticed. For the second phase, I systematically coded each transcript using an excel spreadsheet – the teachers' transcripts were coded together, whilst the head teacher's transcript was kept separate.

I found that teacher responses generally fell under the three main categories detailed within my research questions. These categories were: 1) Accounts of change from the TPD programme; 2) Impact of these changes on students or teachers; 3) Challenges faced on the TPD programme.

In each of these categories, I made a clear distinction between codes that related to either 'Interactive Teaching', 'Use of Technology' or both. For the first category – accounts of when the TPD programme had changed teacher practice – either the discussion of practice in the observed lesson or concrete descriptions from previous teaching were included. Yet types of practices were excluded if they were merely a teacher's reflection or talk about pedagogical ideas, i.e. something the teacher would change to improve the lesson, or something that the teacher thought they *should* be doing but had not actually done. The second category included anything that these TPD programme changes had consequently impacted upon – including student, teacher, and whole-school effects. The third category noted any challenges that the teachers felt they faced, including problems within lessons, outside lessons and during the TPD sessions.

These initial codes were specific and detailed, and equal attention was given to each item. In the first category, 28 codes were gleaned; in the second there were 39; in the third there were 29. Each transcript was coded thoroughly, and a highlighting system was used (Figure 5) to differentiate between types of evidence pertaining to the 3 categories listed above, which later enabled quick searching for specific codes in the transcripts.

Figure 5: Example of transcript coding using Jefferson's Notation (1984). 'Account of change', 'Impact of change', 'Challenges' are highlighted and the codes are noted.

In the third phase of my thematic analysis, I used mind-mapping to explore and to sort my coded data in a non-linear way to form further themes and categories (Nowell et al., 2007; Braun & Clarke, 2006). The initial categories evolved into smaller sub-themes and trends and were defined accordingly (see Appendix F). The frequency of the codes was noted in brackets, so it was clear which codes occurred repeatedly as opposed to codes mentioned once.

One issue that I encountered was that some codes were outliers did not fit into particular themes; however, due to the small sample size of my data collection, I wanted to ensure that all views would be represented. Therefore, as suggested by Braun & Clarke (2006), I placed these codes in a miscellaneous category so they would also be accounted for in the findings.

3.6.2 Video coding: interactive indicators in lessons

Coding the videos of the observed lessons was an intricate and time-consuming task that involved trialling many different systems and continuous modification to find a method that was guided by my research questions and suited my data set. I decided to base my video analysis on the procedure employed by the Teacher Scheme for Education Dialogue Analysis (T-SEDA) team in their current ESRC-funded Impact Acceleration Account (IAA) trial (http://bit.ly/T-SEDA). This method was selected as it similarly sought to characterise teachers' practices through an examination of both teacher and student talk within the classroom. However, it differed in its focus on more detailed dialogic coding through T-SEDA teaching moves. The analysis process was three-fold: 1) Segmentation, 2) Segmentation rating, 3) Overall lesson description (see Appendix G for sample).

1) **Segmentation**

   Segments within each video were defined by the activity type: Whole class/ Teacher instruction or explanation/ Group work / Individual work/ Student Presentation/ When there was a change in these, a new segment would begin (Table 2)

Table 2: Segmentation activity type, acronym and description/definition of these

Activity type	Description/ definition
Whole class (WC)	1) Whole class questioning (WCQ)– when students are asked questions about content by the teacher 2) Whole class activity (WCA)– an activity that involves the whole class, but the teacher is not asking direct questions
Teacher instruction/ explanation (TI)/ (TE)	1) Teacher explanation (TE) – teacher explaining lesson content or process 2) Teacher instruction (TI) – teacher instructing students how to do a task
Group work (GW)–	This included both pair or group work where students are visibly interacting (through verbal and paralinguistic cues) with one another and not just sitting in groups.
Individual work (IW)	Students are silently completing a task.
Student presentation (SP)	When one or more students are presenting something to the rest of the class.

2) **Segmentation rating**

Unlike the T-SEDA IAA video guidelines, my research questions were not trying to analyse the quality of classroom dialogue, but rather the impact of the TPD programme on teachers' practice. Therefore, I devised a simple segmentation rating system (Table 3) to discern the presence of particular activities in the classroom that the TPD programme had encouraged teachers to use. This system was thereby informed by the TPD session resources as well as basic indicators of interaction within a classroom. For each segment, a rating out of 5 was given by assigning one point for presence of each of the above dimensions. The scores from the segment were then calculated proportionately to the timing of the whole lesson to produce a percentage score for each teacher.

Table 3: Rating criteria for video observations

Rating criteria	Within one segment….	This excludes…
ONE: Student involvement/ participation	3 students or more directly involved or participating in the lesson	Choral responses
TWO: Length of student contributions	2 or more students each? contribute over 7 words	Students reading from a textbook, students reading from the board, students reading out a poem
THREE: Dialogic interaction	2 or more students share, discuss, clarify or challenge each other's ideas	When students are instructed to do group/pair work, but no visible interaction takes place and the activity is more similar to a whole class activity or individual work.
FOUR: Teaching moves that encourage student interaction and student participation	The teacher implements one of the following sample moves: open questions; random selection of students in questioning; giving students a 3-5 second wait time before asking students to answer a question; allow students to answer a question in mother tongue and then guide them to the translation.	n/a
FIVE: Teaching moves that indicate teacher facilitation and guidance	The teacher implements one of the following sample moves: Probing and extending a student answer; explicit problem solving; allowing students to discover answers, rather than correcting or telling them instantly.	n/a

3) **Overall lesson description:**

After the coding process, descriptions were added to the lesson coding sheet to add surrounding context. These included the lesson subject, learning objectives, number of students in the class, succession of activities, and any moments of notable interest. Moreover, if the teacher had incorporated technology within the lesson it was expressed in terms of its use; purpose; observable impacts; observable challenges.

3.6.4 Establishing trustworthiness

Throughout my data collection and analysis process, I endeavoured to follow 'trustworthiness' procedures so that my research would be recognised as legitimate with high levels of validity (Table 4) (Nowell et al., 2007; Lincoln & Guba, 1985; Laucker et al., 2012).

Table 4: 'Trustworthiness' strategies used throughout my research fieldwork, research design, data collection and data analysis

Trustworthiness strategies	Description of my specific procedure in relation to these strategies
Length of engagement in the field	I spent over 4 weeks at Mpumelelo High School collecting data and immersing myself within the local context.
Multiple data sources and methods	The variety of data collection documents allowed me to obtain data from a range of perspectives and sources to achieve greater credibility and confirmability of findings.
Self- checking the data analysis	The interview and video coding procedures were carried out twice, with a two-week interval, to check for initial errors and ensure higher reliability.
Use of thick description and visual aids	I used detailed description to outline the context in Nkayi, my data collection procedures, and tools of data analysis to provide readers with enough information to feel that they had experienced the processes (Stake, 1995). Moreover, in my findings section (Chapter 4) thick description is used to describe observations alongside examples of substantiating screenshots from the lessons.
Researcher reflexion	As highlighted in this chapter, due to my afore study of research and methodological literature, I made sure to constantly keep records and notes throughout my data collection and analysis. This allowed me to revisit these notes and pick up important reactions and ideas I had throughout the study. Moreover, guidance from experts in this area of research – such as my supervisor and other members of the Mpumelelo team – allowed me to reflect and refine my procedures.

Interrater reliability of Data Analysis tools	To increase the interrater reliability of my analysis, an interview transcript and video recording were selected at random and coded by Dr Christoph Pimmer - an expert researcher and lecturer in Global Learning and Digital Media in Knowledge and a collaborator with the Swiss Mpumelelo Project team - using my data analysis tools. When coding the transcript, Dr Pimmer articulated that he found it difficult establishing which aspects of teacher talk were 'concrete' examples of prior practice, and which were teachers just talking about pedagogy. This meant he highlighted more 'Accounts' of teacher practice than in my transcript coding. I therefore ensured that 'concrete' examples were defined more precisely in my analysis description and for my reader (see footnote 4). In the video coding process, my analysis of the video recording resulted in an interactivity score of 35%, whilst Dr Pimmer's interactivity score for the same video was 38%. This 3% discrepancy suggests a high interrater reliability as there was only one coding difference between us that resulted in a divergence.

CHAPTER 4: Findings and Discussion

In this section, I present the data findings emerging from analysis across the interviews, observations and TPD observations to reveal teachers' ideologies, beliefs and practices (RQ.1) in relation to interactive pedagogy (RQ.2) and uses of technology (RQ.3). Evidence of teacher practice derives from either the snapshot lessons or from interview sections when concrete examples of previous practice were described. Perceptions and beliefs are drawn from headteacher and teacher interviews and when teachers have voiced opinions in TPD sessions. Using a one-way analysis of variance test (ANOVA), I determine whether there are any statistical significant differences between the groupings of teachers (Facilitators, Pioneers, other teachers) who have received different levels of exposure to the TPD materials (RQ.4).

These data sources are used simultaneously to compare, contrast and corroborate findings through a methodological triangulation. Trends in the data sets are examined thematically using the procedure outlined in the Data Analysis section (3.6). Due to my case study approach and limited sampling selection, I have provided descriptions of the majority perceptions and practices which relate to interactive pedagogy and/or the use of technology, as well as minority views and contradiction to provide a detailed picture of the case and represent the voices of all the teachers. This indicates my constructivist framework which explicitly seeks many perspectives to compile collective and diverse/singular ideas of what occurred (Stake, 1995) and the researcher's subjective role (discussed in-depth in section, 3.5) in constructing interpretations from the collected data (Charmaz, 2006). This acknowledgement is essential given my detailed commentary and analysis on data of teachers' perspectives and practice.

Overall, positive and negative examples of change were actively sought which focused on the specific pedagogic elements within the OER4schools programme material. The concentration on these practices is used to produce an evaluative model on the TPD programme in the conclusions in Chapter 5. These findings are additionally discussed in relation to frameworks and findings of relevant theoretical and research-based publications to consider their position within surrounding literature. In particular, the results are compared to research publications on the previous use of the OER4school materials in Zambia (Hennessy et al., 2016; Haßler et al., 2014).

First, I explore teachers' beliefs and knowledge of pedagogy and learning within the classroom due to its essentiality as a precursor to pedagogic change (Guskey, 2002). Then I consider the overarching themes and implications arising from teachers' perceptions and use of interactive pedagogy and ICT. These changes are then linked to teachers' perceptions of student learning and outcomes which is the central purpose behind all TPD programmes (Westbrook et al, 2013). Finally, experiences and

barriers external to classroom pedagogy are discussed to draw a wider contextual picture of the findings.

4.1 Shifts in teacher pedagogic beliefs

Without strong beliefs and confidence in new pedagogic methods, it is unlikely that teachers' practice will be deeply or sustainably influenced (Brinkmann, 2015). All of the teacher accounts demonstrate a clear change in mind-set and a strong belief, knowledge and understanding of interactive teaching methods and their strengths (12)[7]. This can firstly be seen through the teachers' definitions of interactive teaching which accurately conceptualised areas such as teacher facilitation/guidance, student self-discovery, peer-learning, discussions, student-centred practice etc. Some teachers saw interactive teaching as the process of learning between teacher-student and student-student (4), or as a way to produce inevitable learning in students (2). Significantly, half of the teachers subsequently placed these new practices in contrast to a more ineffectual portrayal of traditional methods. These traditional methods were often described through negative language and imagery: "**if you teach from the chalkboard they will not learn anything**" (Joseph); "**Tries to do away with that mentality that the teacher is the fountain of knowledge**" (James).

Moses, for example, highlights a transformation of his teaching methods from rote to interactive which is attributes directly to the TPD programme:

> **Moses: They have taught us that the traditional methods, those traditional methods that we use, they have given us confidence to let go of, the what (.) the traditional methods. And we now have confidence in these new teaching techniques. We believe for example in Africa # we believe, the learner cannot learn without a stick. So now we're realizing that no, these methods they keep learners engaged. When they are engaged, they become to love school. Most of the learners (.) we saw a lot of dropping out of school (.) but now their life is good because of these methods, they are now actively engaged in learning. So I think these methods have had a positive impact on our teaching…so they're learning. ## As for me, teaching has reduced traditional methods that are used with the teacher to talk from the morning up to the sunset, and writing on the blackboard writing, but now it gives me time to let the kids interact.**

This perspective demonstrates recognition of commonplace teaching practices, such as corporal punishment and rote learning techniques in similar contextual settings. Instead, Moses attributes that the TPD has allowed the teachers the *realisation* that interactive methods are better pedagogic substitutes which facilitate greater student engagement, attendance, enjoyment and interaction.

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[7] A bracketed number next to an activity or opinion represents the number of teachers who discussed this in their interview, or used this in their snapshot lesson.

Not only does Moses illustrate a shift in beliefs, but he explicates the support of the TPD as educating teachers as well as giving them the *confidence* to relinquish former practices. This confidence is key: even if teachers are convinced by new pedagogies, the implementation of these techniques is often highly challenging for teachers within these contexts therefore, without confidence, their practice may revert to former rote learning (Haßler et al., 2014).

4.2 Interactive pedagogy: new activities, roles and dynamics

In this section, a general overview of interactivity indicators in the teachers' lessons is surveyed through the observational coding results. The key interactive practices of peer-learning and questioning are navigated to consider progress, challenges and absences. These areas are elaborated to discuss the dichotomies of how teachers have experimented in generating a comfortable classroom environment.

4.2.1 Lesson interactivity coding

A set of rating criteria was used to measure interactivity elements central to the TPD materials: Student participation; Length of student contributions; Dialogic interaction; Teaching moves that encourage student interaction and student participation; Teaching moves that indicate teacher facilitation and guidance (See Chapter 3 for more detail). Examples of these interactive elements from the snapshot lessons are represented in Table 5.

Using the interactive coding scale, each snapshot lesson was given a percentage of interactivity elements, to offer an overview score (See Table 2, and refer to 3.6 for more detail of the coding system). As with any TPD intervention, level of take-up varied with individuals: "no new program or innovation will be implemented uniformly… Teaching and learning are influenced by a multitude of situational and contextual variables" (Guskey, 2002, p.387).

The categories of low, medium and high interactivity (Table 6 & 7) are based on a qualitative interpretation of the lessons. Though these data are not assumed to be representative of teachers' practice generally, they do offer an insight into what their best practice might look like and which activities teachers are prepared to use and experiment with.

Table 5: Interactivity elements from snapshot lesson observational coding procedures. Each element is provided by one or more specific examples from the snapshot lessons

	EXAMPLE ONE	Example from a video	EXAMPLE TWO	Example from a video	EXAMPLE THREE	Example from a video
ONE: Student involvement/ participation	3 or more students are selected to answer a question (closed or open)	**Joseph** - Segment 1 - recap of a previous lesson: what are the characteristics of dairy farming?	In group/pair work - 3 or more students are visibly verbally or physically participating	**Prosper** - Segment 3 - students discuss and define what adjectives are with their partners	3 students or more contribute in a non-verbal way - e.g. write an answer on the board, participate in an 'ice-breaker'	**Munya:** Segment 1 - students are told to freely write on the board to recap content from the previous lesson
TWO: Length of student contributions	2 or more students answer a question using 7 or more words through questioning or student presentations	**Kayla** - Segment 3 - students give answers that are 7 words or longer	In group/pair work - 2 or more students are visibly contributing answers using 7 or more words	**Kelvin** - Segment 5 - students brainstorm as a group the different stages of producing carrots.	2 students or more using 7 or more words write a response to an answer that is visible to the whole class - e.g. write on the chalk board	**Arani** - Segment 3 - students write on the board their answers from their research on the digestive system.
THREE: Cooperative learning	In group/pair work - 2 or more students are visibly engaging with each other about lesson content	**Joshua** - Segment 2 - students collaborate to answer a maths question.	In a whole class discussion or activity, students engage with each other's answers E.g. A student gives an answer, the teacher asks another student to engage with the answer given by the first student	**Godfrey:** Segment 5A - a student gives a presentation and other students are asked to directly engage with this	n/a	n/a
FOUR: Teaching moves that encourage student interaction and student participation	The teacher asks an open question to the class - i.e. a question that does not have a yes/no or one-word answer, but has many possible answers.	**Abel:** Segment 1 - open questions are directed at the whole class which produce a range of answers	Teacher selects students at random for questioning, rather than relying on 'hands up'. This can be done through the use of a prop (e.g. throwing round an object)	**Moses** - Segment 1 - teacher gives students a piece of chalk to throw around the classroom - whoever has it must give one recap point about the previous lesson	Giving students a wait time of 3-5 seconds before asking another question.	**Godfrey-** Segment 5C - teacher gives students a clear wait-time before selecting a student to answer a question
FIVE: Teaching moves that indicate teacher facilitation and guidance	A teacher trying to extend the answer of a student. E.g. asking the student 'why?'	**Tania** in segment 5 probes a student- asking them 'why?'	Knowingly accepting an incorrect answer from a student, and only correcting them later in the lesson.	**Kayla** - Segment 6A - Incorrect answers are given by students. These are still written on the board, and the teacher only demonstrates how they are incorrect later.	Explicit problem-solving activity	**Arani** - Segment 1 - Teacher says she will not tell students any answers; they will find out on their own this lesson.

Table 6: Interactivity indicator results (%) from each teacher's snapshot lesson

Rank	Name	Group	Interactive % (2dp)	Interactivity level
1	**James**	**Pioneer**	**10.84**	**Low interactivity**
2	**Kayla**	**Teacher**	**12.39**	**Low interactivity**
3	**Joseph**	**Teacher**	**13.27**	**Low interactivity**
4	**Munya**	**Pioneer**	**15.3**	**Medium interactivity**
5	**Joshua**	**Pioneer**	**25.2**	**Medium interactivity**
6	**Abel**	**Teacher**	**29.71**	**Medium interactivity**
7	**Tania**	**Teacher**	**35.2**	**High interactivity**
8	**Kelvin**	**Facilitator**	**44.86**	**High interactivity**
9	**Godfrey**	**Facilitator**	**45.18**	**High interactivity**
10	**Arani**	**Facilitator**	**45.29**	**High interactivity**
11	**Prosper**	**Facilitator**	**46.87**	**High interactivity**
12	**Moses**	**Pioneer**	**53.25**	**High interactivity**

Table 7: Descriptions of the characteristics of lessons of low, medium, high levels interactivity

	Low levels of interactivity (0-15%)	**Medium levels of interactivity (15-35%)**	**High levels of interactivity (35%-55%)**
Number of teachers' lessons	3	3	6
General lesson characteristics	These lessons were generally characterised by teacher explanation and sporadic closed teacher questioning. Questioning is used at the start of the lesson, but a very small number of students contributed per lesson and most questions are answered chorally. There were no activities involving group or pair work.	These lessons were still dominated by teacher explanation, but usually involved a few interactive techniques at the start or end of the lesson. For example: brainstorming used at the beginning of the lesson to recap, brief group/pair work used.	These lessons employed a range of teaching techniques and activities. Group work was used frequently and students worked collaboratively. Questioning was varied and different props and methods were used to include a wide range of student participation.
Example lesson description	*Questioning is used at the start of the lesson to recap previous lesson. Teacher explains new content and writes this on the board. There are occasional closed questions which students answer chorally. The students copy down what the teacher is writing on the board whilst he talks. Teacher writes a question on the board and gives students a minute to write an answer on their own.*	*Prolonged teacher explanation at the start of the lesson to recap the previous lesson and model the concepts for this lesson. Students are put into groups to complete tasks, getting put into groups takes a long time. Students present answers on the board – though many answers are incorrect - and group work continues. This group work is interactive, and all students appear to be participating.*	*High levels of interactivity throughout the lesson. Activities are either student-centred and whole-class – there are very low levels of teacher explanation. In the group work activities, all the students are engaging, and every group or pair participates and feedbacks answers. The students are highly focused throughout the lesson.*

These results demonstrate that although *all* the teachers voiced their understanding and beliefs in the benefits of interactive methods for student learning, a quarter of the teachers still used wholly rote learning practices and another quarter used only minimal interactive techniques within their snapshot lesson. This reveals a discrepancy between teachers' beliefs and knowledge, and their decision and/or ability to implement these activities into all their lessons.

Interactive indicators (%) in snapshot lessons

|	Facilitator Group	Pioneer and Teacher Group
1	44.86	53.25
2	45.18	12.39
3	45.29	13.27
4	46.87	15.3
5		25.2
6		29.71
7		38.14
8		10.84
n	4	8
X	45.550	24.762
s	0.899	15.041
X$_{ave}$	31.692**[8]	
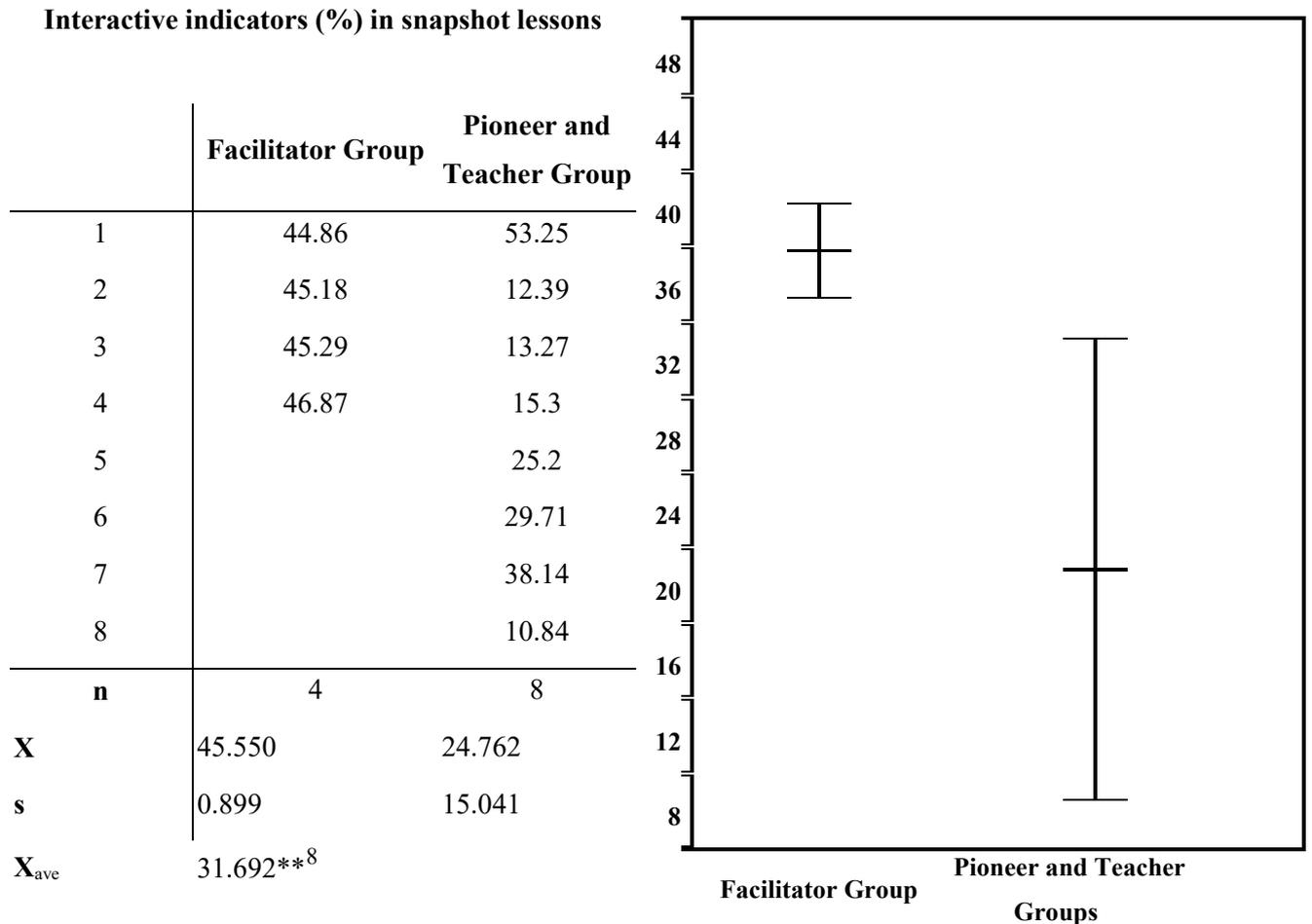
Figure 6: An ANOVA one-way completely randomised showing the statistically significant difference between the Facilitator and combined pioneer and teacher groups

A one-way ANOVA test[9] was used to determine whether there was any significant variance between these groups who have had different exposures to the TPD programme (RQ.4). No statistically significant difference was found between percentages of the Facilitator, Pioneer or teacher group

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[8] ** - Significant at 5% (P-value = 0.0186)

[9] The statistical significance determined by the P-value reported in the ANOVA test. The difference between any two groups is statistically significant at 1%, 5%, and 10% if the P-value is less than 0.1, 0.05, and 0.001 respectively. Significance at 10%, 5%, and 1% are denoted by *, **, and *** respectively.

lessons. However, there was a statistically significant difference between the Facilitator and combined Pioneer and teacher groups (Figure 6). This suggests that in the snapshot lessons, the teachers in the Facilitator group used more interactive features than the other teachers in the Pioneer or teacher groups. The Facilitator teachers have received the most training under the TPD session and have had the responsibility of leading the sessions for the other teachers.

However, due to the lack of data before this programme began, it is difficult to establish whether this difference of interactive elements between the groups is a result of the programme or was already present. The teachers in the Facilitator group may have been selected due to their interest in pedagogy, experience and high levels of teaching ability. Due to this non-random assignment to treatment, these teachers may have characteristics that make them more likely to use these techniques in their lessons. Therefore, evidence of more interactive pedagogy within facilitators' practice cannot be fully attributed to education variable of the TPD programme. Yet, by using this evidence in tandem with interviews and TPD session observations we can gauge a fuller picture of the journey of teachers' beliefs and practice.

After watching the recorded video of their lesson and asked, 'If you were to teach this lesson again, is there anything you would change or improve?', the three who were rated 'low levels of interactivity' reflected that the lesson would have been improved with more interactive techniques:

> **James: I think I will change maybe to include some more teaching methods and learning methods. Like think pair share…I think to get everyone in the class involved everyone involved as you have seen, it is a big class. It's a huge class. So, the questioning techniques I used, some may not be involved but pair share, everyone will be able to participate**

> **Kayla: I want to stop that lecture method. I want to improve my teacher interaction. I think that is the best method. And I also want to encourage my leaners to research so that they are able, when we are doing people teach interaction, we will be together. Not the teacher being the one who is giving information.**

> **Joseph: Because if we are doing the kind of teaching that I was doing if this one is within the class, because if someone is (.) you don't know, you know that they're in the class physically, but brain-wise, they may be thinking of something else… So under interactive teaching, you will be monitoring them in small groups. You'll be able to see if all of them are participating.**

This is a very interesting finding and may illustrate a number of significant aspects. Firstly, it demonstrates that these teachers that used low levels of interactive features were able to identify this within their own lesson. The teachers are also able to identify the drawbacks of the teaching method they had used: lack of student involvement, teacher as a transmitter, unable to monitor what students

are understanding. Subsequently, the teachers explain how an interactive method – pair-share, student research, group-work – would counter this problem. Therefore, although these teachers are not yet implementing more interactive pedagogies into their practice, their reflection demonstrates their understanding, belief and aspiration to this type of teaching. Moreover, this finding also suggests that video segments can be an appropriate vehicle to stimulate reflective thinking in teachers.

4.2.2 High use of peer learning activities

In the interviews, teachers reported a high use of teaching activities that aid peer-to-peer learning and student involvement. Group work (9), student presentations (6) and pair-work (4) were the activities of the highest frequency described.

James provides a concrete example of this from a previous lesson:

> **James: I used interactive teaching when we were doing a topic on diet. The learners (.) in groups (.) were to look out for one nutrient part of the balanced diet. I asked the learners to go and research that particular nutrient and to come up with pictures that have food that has that nutrient.They presented it they displayed it to the class displayed it the food groups and types of food that contain that particular nutrient... It helps student learning because there was cooperation amongst the group members and also competition in the groups and each group would try to ensure that it is researched more than the other groups.**

This activity illustrates a method which employs student co-operation of discovering and researching information as well as peer teaching through subsequent student presentations to the rest of the class. Students have utilised technology as a knowledge base, so they can share new information with the class.

Other teachers felt that group work heightened student involvement (5) and aided students' learning, especially those who are shy or lower attaining (4).

> **Kayla: They may be afraid of the teacher or they're not close to the teacher but to each other they may be very, very close to each other and will talk. If I take a good learner, or the best learner and I asked the best learner to do group work with a slow learner. I know they understand (.) they are the same the same level at the same level they understand each other. They are able to come up with something to understand each other, especially a new concept.**

When explaining the reasoning behind the group work she used in her snapshot lesson, Kayla argues that students who may not directly contribute in class are much more comfortable in engaging with each other. Pair-learning may be effective because students may understand their peers more than the teacher and when pairing students of different abilities, the higher-attaining students can help lower-

attaining ones. Congruous with results from the Zambian OER4schools, this highlights how these activities can "bridge language barriers and free discussion" and demonstrates teachers' appreciations that they benefit certain students (Haßler et al, 2014, p.14). Importantly, group work in which students discuss a shared task has been found as a highly effective teaching strategy in LMICs (Westbrook, 2013).

In accordance with the high number of accounts teachers provided of group work, in the snapshot lessons group work was utilised by half of the teachers (6). This was conducted in a variety of ways for different purposes and subjects: same task group work, different task group work, and use of tablets in groups. During these activities, the teachers were always proficient at circulating the classes to support the respective groups through further explanation or clarification, technical support or probing (see Figure 7.). This teaching move is highly significant: Hennessy et al. (2016) noted that in Zambia, teachers conventionally sit at their own desks during group work rather than continuing to facilitate. However, when using the OER4schools resources, this research also demonstrated that teachers deviated from this typical style.

One challenge that teachers faced in their snapshot lessons was the length of time it took for the students to actually get into groups – in one class it took over 3 minutes for the group work to begin after the teachers' instructions. Furthermore, students took a while to participate fully in the task and were initially silent for a few minutes before starting to discuss and interact. These issues are to be expected, yet it may suggest that students are not be very familiar with the format of the activity.

Figure 7: An example of group work in an Agriculture lesson where the teacher is circulating the classroom to guide students where needed. The table layout is conducive to the group-work taking place.

4.2.3 Questioning techniques and student selection

Half of the teachers mentioned the use of questioning in their interviews and all the teachers used questioning of some form within their snapshot lessons. The questioning examples discussed and described were often specific examples of activities from the TPD programme such as random selection, brainstorming, magic mike, and mute-chalkboard approach. In snapshot lessons, teachers often used a form of questioning at the start of the lesson to either recap students' knowledge on previous lessons or to see what they already know about a topic (Figure 8).

Two teachers made an effort to experiment with the selection process of students. For example, Moses used the 'magic-mike' technique: a piece of chalk was thrown from student to student, whoever held the chalk had to contribute to the Economics brainstorming on Limited Liability Companies. Whereas Kelvin used a box with small pieces of paper with an alphabetical letter on each that several students picked out. If the letter selected was the first letter of their names, these students had to stand and provide a piece of information they remembered from the previous lesson (Figures 9 & 10). Later in his SRI interview, Kelvin asserted that this technique was to increase student accountability by ensuring **"everyone was ready now for the lesson."** The variance of these techniques are demonstrative of teachers' efforts to experiment with new pedagogies in creative ways within their classrooms.

Figure 8: An example of brainstorming using the mute-chalkboard approach at the start of a Biology lesson. "Anyone you can come forward and pick up the chalk and write something that you still remember on cells or chemicals."

In this extract, Godfrey is discussing his use of random selection in the 'snapshot' lesson, and a further example of the mute chalkboard approach in a previous lesson.

> **Godfrey: …we're talking approaches where everyone has to be ready to talk you don't know who's going to be next. You pounce on everyone. So everyone is alert and ready to learn and say something. At times we use those, especially in the class as small as I was teaching, the one in the class I was teaching the smallest that one #. The mute chalkboard approach. I used this one in my last lesson on characters. The mute chalkboard approach (.) where they can just go and write their opinion on the board, without saying a word... I liked it because it actually takes away the hesitancy to say something from the students you are not saying anything you are simply writing or your ideas on the board. At the end all those ideas on the board will be anonymous. Then you start sharing ideas and analysing them.**

The teachers who used random selection saw it as a method which increased overall student participation, monitored student progress and, like Godfrey's description above, as a way to increase student accountability and alertness within the classroom. One teacher saw a mixture of hands-up and random selection the most beneficial depending on preferred outcome. He argued that hands-up **"developed a spirit of competition…[and] allowing them to compete makes them excel"** (Prosper). Whereas another teacher saw that by selectively picking students he could ensure that both boys and girls were participating (Moses). This is demonstrative of teachers' awareness and reflection to employ certain teaching moves to produce a variation of intended results.

In contrast, the mute chalkboard approach prioritises anonymous student participation to improve confidence and reduce 'hesitancy.' Godfrey continues that these student contributions are then shared and analysed, showing how students can contribute knowledge to the class and subsequently engage with each other through dialogic interaction. He also highlights that these approaches are easier to use when the class sizes are smaller. This is a challenge noted by O'Sullivan (2004) who notes that LCE is more conducive when there are fewer students per class than the average number in a rural African classroom.

There was a significant absence of concrete examples surrounding open questioning, cumulative talk and expanding student responses through probing questions. This was synonymous with the results from the snapshot lessons: though open questions were used frequently, there was very little or intentional use of cumulative talk and expansion of student answers. Moreover, throughout the whole twelve lessons only one student asked the teacher a question and there was one instance where a teacher used code-switching to guide a student answer. This exemplifies that the Zimbabwean teachers are not yet making use of these higher-level questioning techniques of expanding responses, encouraging student questioning and using local languages which have been found as teacher

techniques with the most positive outcomes (Westbrook et al, 2013). Therefore, although there are hints of sharing and collaborative elements, the classroom environments cannot be deemed as wholly reciprocal.

Figure 9: Students selecting letters out of a box for a random selection questioning technique: "When he picks a letter and your name starts with that letter, you will be the one who is asked"

Figure 10: All students with names beginning with 'D' are standing up, ready to contribute what they remember from the previous lesson.

4.2.4 Classroom environment: developments and challenges

One third of the teachers argued that they felt these activities created a comfortable atmosphere in their classrooms (4). Questioning techniques, such as brainstorming, mute-chalkboard had made students more confident and willing to share.

One teacher explained that through questioning in his snapshot lesson, he was trying to create a more open environment so students were willing to share. By giving students a longer 'wait-time' and urging students to **'feel free to say whatever you think',** he reasoned that he was try to take away **"the fear of giving the wrong answer"** so the class could work out the correct answer together **(Godfrey)**.

In three snapshot lessons, teachers made a clear attempt to avoid telling a student their shared answer was incorrect so students could make mistakes. Yet, the majority of teachers found this challenging. In response to the interviewer question of 'Is there anything you would change if you taught this lesson again?', Moses responded:

> **Moses: I think maybe my response on wrong answers. I need to work on that. When a learner gives me wrong answers, this answer is wrong. I think I feel like demotivating the learner, I am still learning how best I can help the learner in such a way that it won't harm them. But at the end, it is difficult to do.**

This suggests that teachers need to learn how to correct student answers in a way that does not damage a positive learning environment.

Seating plans were not mentioned at all by teachers in the interviews as an effective tool for learning and cultivating a secure classroom environment. Yet, in the snapshot lessons teachers used table layouts to create more effective group-work settings.

In other research, creating this safe environment has led to a divergence from the behaviourist 'carrot and stick' approach as it encourages student participation without fear or corporal punishment and predisposes students more favourably to learning (Nakabugo et al., 2006; Westbrook, 2013). Moreover, Alexander (2018) sees this type of supportiveness as a way to allow students to talk freely because it minimises students' sense of risk and their fear of its consequences.

4.3 ICT as a supplement to learning

In this chapter the themes that emerged around the sue of ICT are summarised. These are (1) the accounts of teachers that videos would make teaching more visual; (2) the means to support student inquiry and autonomy; (3) and the impact technology can have on teacher planning. The fourth theme

explores the general technical drawbacks and issues of accompanying technology within educational spheres.

4.3.1 Visual tools making learning more authentic

Within the classroom, teachers reported the transforming effect of ICT on connecting realities of the world to students in rural schools. These examples are similar to other research that found technology can allow students to experience environments through virtual tools (Ruchter, et al., 2010). Teachers gave concrete examples of using videos in their lessons (6) or using the projector to show an image (2). In the snapshot lessons, technology was used 4 times: to read a poem, to access a maths worksheet, to access a biology app of the digestive system, to watch a video on osmosis.

In an interview, a concrete example from a geography lesson was given:

> **Joseph: Our way of teaching has been changed. People were used to just been told # things. Kids they do not think, think these things really happened. I was teaching rivers that other day. I bought a video of the river. I was showing them through the projector, they were seeing water flowing. This side the geographical location of where we are in Nkayi, we do not have rivers. But there's a topic which is called rivers geographical. So bringing the river into the classroom, through these gadgets is helping us much because kids are now having a picture of what we're discussing, rather than just telling them we have a river that flows from upland to (.) lowland.**

The use of technology here is an interesting example of connecting students in rural areas to experiences and environments that may be proximally inaccessible to them. Through this visual presentation of concepts, students are given a heightened version of veracity to subsequently recognise and discuss a topic. Joseph explains that in the past students were being "told things", yet now they are given a source of information which the student can use to "discuss." As the students no longer have only to rely on the teacher's descriptions and can simultaneously see it for themselves, there is a shift from the informant of which student knowledge can be acquired. A similar example was also provided by a P.E. teacher (Kayla) on using videos to illustrate tennis and another by an Economics teacher (Tania) on sea transport. In these instances, students were able to use videos as sources of information to aid students to complete a task.

Moreover, a science teacher noted that technology could be a stand-in for resources that may be absent in rural schools:

> **Munya: Here, we have some challenges of like the equipment to use for Sciences like chemicals and other things. So I can prepare those experiments, download the videos then I forward them**

to (.) I forward those videos to their tablets so during the time of experiments, we can do the experiment using the tablets.

Whilst not able to experiment themselves, students can visually experience the scientific processes through new mediums.

However, though these videos may be utilised in lessons, it does not necessarily mean that rote learning is not present. In one of the snapshot lessons, a video on osmosis and diffusion was given to students to watch on their tablets in groups. Yet, this was preceded by over 17 minutes of teacher explanation where no interactive indicators were present at all. Therefore, though the use of videos can be effective, it should be used as a medium to equip students with new knowledge, and not as a supplement to rote learning methods.

4.3.2 Impact on lesson planning

Half of the interviewed teachers felt that the TPD training and technology resources had enhanced their planning for lessons in a variety of ways.

Kelvin: Firstly, when planning yeah I can now plan a lesson faster. [Planning] used to be an hour or 30 minutes (.) Yeah I'm now able to do that mostly using the activity template we learned about. # It's easy and very effective like I can have an introduction parts then suggested an activity for the lesson. Basically when planning it has helped me a lot and also it has # made me improve, help me improve in fact how to search for information and how to organise the resources for teaching.

In this account, Kelvin explains how his planning has become more efficient and structured using a suggested online lesson template provided by the TPD programme. Moreover, using the tablets and accompanying software, he has found relevant information and resources and saved these ready for his lessons.

In addition, teachers felt that through the tablets they could safely store soft copies of lesson plans (2) and access quick answers and information relevant for their lessons through offline software materials (5) and downloaded textbooks (1), as well as use the Wi-Fi connection to find global information (2):

Joshua: I live in a village, but I can learn from someone in China or another country. If they are teaching the same topic, I admire some of the things and I can copy some of the things and try to use them here.

This shows that access to more information or the lessons of other teachers (through TES teaching resources for example) has the potential to improve teacher's subject area understanding. Moreover, it

may also provide teachers with novel ways to teach and vary their lesson sequences – another key strategy of effective pedagogical practice (Westbrook et al., 2013).

Yet, in contrast, a quarter of the teachers felt that the integration of technology - as well as interactive methods - within their lessons was increasing their lesson planning time (2) and demanding extra preparation before the lesson (1). In her experience of viewing teachers' lessons, the head teacher argued that teachers are still in need of more practice to plan technology effectively in their classrooms. She argues that teachers see ICT as often wasting a lot of time when they have experienced difficulties with it in lessons: **"Sometimes you spend 10 minutes trying to set up your project then the reason is gone."** Though teachers want to use technology in their lessons, they are often not sure how to incorporate it in time effectively to aid students' learning.

4.3.3 Technical barriers

Teachers also voiced the various technical challenges they have faced that have been barriers to their technology use in the classroom. These include issues with the hardware: shortages of equipment (4), troubles with charging tablets (3), difficult accessing the equipment (3), difficulties with the modem (1), regular power cuts resulting in the loss of the Wi-Fi (1). The head teacher also described the difficulties of the student-teacher ratio of tablets and having only one projector in the school (see Figure 11).

Figure 11: Students watching a video on osmosis and diffusion. This shows a ratio of 8 students to 1 tablet.

In one TPD session, the facilitators could not find the location of an android application within the RACHEL server - this resulted in almost 40 minutes of inactive TPD session time. Teachers

suggested that they still need more ICT training and they have struggled with the equipment hardware and software (2). These issues may provide support as to why there were less examples of technology uses within the classrooms in snapshot lessons and interviews.

4.4 Impact on student educational experience and learning

The aim of all TPD is to enhance the students' educational experience and learning outcomes (Burns et al., 2015). The interviews veered towards this, and I frequently asked the teachers if they perceived that certain teaching moves and practices they had used or described had an impact on student learning.

As discussed in accounts of pedagogic change and technology use above, teachers noted that students now find lessons more exciting and enjoyable which has led to heightened student motivation and engagement (7) or focus (3). The classroom atmosphere is safer through anonymising activities so students are more confident (4). Moreover, there is increased student participation and involvement in the lessons from shy students (7) and lower-attaining students (6). These findings are synonymous with findings from Zambia by Hennessy et al. (2016) who argue that, given the poverty and challenges students face outside of school, helping them enjoy learning activities is significant.

The majority of teachers generally linked these changes to non-specific outcomes - such as longer-lasting learning (6), more learning (5) or a greater understanding (2) for students – rather than hard evidence such as assessments or the increase in correct answers. This is to be expected as, with similar types of programmes, student progress is not necessarily discernible straight away (Resnick et al., 2010; Alexander, 2018).

However, the headteacher and a few teachers (3) also substantiated these claims with external indicators. For example, the head teacher attributed the technology and new interactive methods as the main contributor to an increase in student enrolment, decrease in dropouts and pass rates. An increase in student attendance was also noted by three other teachers, corroborating anecdotal evidence in the study by Hennessy et al. (2016) in which Zambian teachers became more aware of students quietly dropping out of school.

> **Nkosi: The learners themselves started to develop interest towards learning and this has been an increase in enrolment of learners to school. And then we also realized the reduction of learner dropouts, the learners have to attend school for a longer time. So there's no longer a dropout rate, the dropout rate dropped… Even on the pass rate, it increased the percentage pass rate. Initially it was around 3.3%...the highest it was 24.2%...**

Another teacher noticed similar impacts:

Godfrey: And some of them. I didn't expect some good (grades), but some passed, who were not supposed to pass as far as I was concerned. Because of the way we were using those methods, the way we made them like the subject… it has changed the face of the school, we can now actually boast of being one of the one of the few schools in rural areas that has access to the internet.

In areas where dropout rates are high, it seems even more key that students enjoy their education and also believe that it is worthwhile. Moreover, an improvement in the reputation of the school may be essential to increase enrolment and parental support (Mahura & Hungi, 2016).

4.5 Teacher experiences outside the classroom

4.5.1 Increased teacher collaboration

When asked what they thought were the strengths of the TPD programme, one third of the teachers relayed that they felt it had increased teacher collaboration throughout the school. The teachers discussed a new conducive culture of teamwork, greater staff bonding and collaboration within the meetings which accordingly enriched their teaching. One example given was, if a teacher had an issue within the classroom this would be shared in the Wednesday session and the other teachers would find helpful solutions.

Prosper: I noticed that it unified the teachers, it has brought us together you see. When we meet every Wednesday (.) that was not there before. It is now like a culture that we meet every Wednesday we discuss our lessons we discuss our methods that we use to teach, we evaluate our work, we make the way forward… In our programmes again we have come to understand other departments. I come from the languages department and there's the science department, the commercials department and we have the practical department. So I have come to understand how other departments operate…I have been paired with the science department teacher and we have observed each other teaching and you come to understand them and you pick one or two things that you can also use in your what, your department. That has been very very helpful.

Prosper's account illustrates the direct influence the weekly TPD sessions has had over the staff and teaching and learning ethos. Teachers are sharing their pedagogic methods and experiences through the cyclic processes of discussion, evaluation and progression. This is demonstrative of two essential facets of the TPD programme that research has shown are highly beneficial. Firstly, it confirms that the nature of these sessions are themselves interactive and dialogic; teachers are involved and participating, their experiences are communicated and these are discussed and analysed by others (Frisoli, 2013). This necessitates an environment that is safe and open where teachers can flexibly share opinions and experiences (Haßler et al., 2014). Moreover, in the TPD sessions the Prosper represents the teachers as 'reflective practitioners': **we discuss our methods that we use to teach, we**

evaluate our work, we make the way forward. They are responsible professionals who can: frame their practice, reframe it through prior knowledge and experience, and develop a plan for future action (Clarke, 1995). Mukeredzi (2013) sees this type of cycle as 'transformative' as through this collaborative inquiry, "new knowledge [is] constructed and then applied to subsequent activities" (p.97). This is corroborated with TPD session observations – for example in the TPD session on 13.01.19, a teacher voiced difficulties with students' low level of spoken English as a barrier to questioning. In response, another teacher suggested the use of brief code-switching to aid students' understanding. He described an example where he had a similar situation: a student could not answer his question in English so he asked the student to reply in Ndebele instead; he then asked another student to translate this answer back to English. This interaction is illustrative of teachers voicing their difficulties and using the experiences and opinions of their colleagues to reach solutions.

Furthermore, Prosper discusses the benefits of cross-curricular links within a secondary school. The teachers' observations of different subjects and discussions within TPD sessions (Figure 13) allow them to see new teaching and learning methods to utilise in their own practice. This can be extremely helpful at getting teachers to introduce concepts in new ways in their own subject, make links across the curriculum and provide a general awareness of what pupils are studying in other subjects to frame their own lessons (Savage, 2012) (See Figure 12)

Figure 12: A Teacher Professional Development session. Teachers are sharing the types of open questions they could use in their different subject specialisms.

4.5.2 Contextual influences for Mpumelelo teachers

It is important to also highlight the external realities that these teachers faced during the most recent two years span of the TPD programme. Firstly, a few teachers discussed how their heavy workload (3) and general congestion of the school day meant they sometimes would not be able to implement methods from the TPD sessions (2): **Godfrey: Why simply because they are overloaded. After that they may not have not have enough time to really plan to use those methods.**

Or that even due to this workload, they would struggle to attend the sessions:

> **Prosper: There have been many challenges through the PDP program in terms of attendance. In the beginning, it seemed to be wasting time. Yes, I would like to say when it started, it seemed to be wasting time. But when we got into the program, I got to like it. And I think that has been happening to other teachers as well. I feel they are really coming on board.**

The workload of teachers is a very common barrier to teacher motivation and TPD programmes. For instance, Bennell & Akyeampong (2004) argue: "large class sizes and heavy workloads in relation to pay (the effort-price of work) also make teachers resistant to the introduction of new teaching methodologies and other innovations" (p.12). Moreover, Prosper's account shows a process of teacher motivation in relation to TPD sessions; teachers' enthusiasm should not be expected to be instantaneous, they must first be convinced of the effectiveness of the TPD programme. Mercer et al. (2017) corroborate this finding by explaining that researchers must effectively prove to teachers the value of pedagogy if they are to expect a shift in traditional patterns.

Moreover, during this study there were extreme circumstances that posed major disruption to the TPD. Due to Zimbabwe's unstable political situation, the inflation of the Zimbabwean currency resulted in teachers' salaries becoming a third of their value, whilst food and transport costs increased. In response to this, teacher unions called for a teaching strike resulting in a loss of both teaching and TPD sessions. The shortage and rapid price rise of petrol made transportation more scarce and expensive so teachers made less frequent visits to their families - who often lived hundreds of miles away. Moreover, the head teacher explained that due to the devaluation of the national currency, the purchase of needed equipment for the school has been delayed. Schools were closed for some days owing to threats of violence towards teachers who flouted the strike. These factors have unfortunately compromised continuity of the programme and may have had a serious impact on teacher morale, motivation and accountability (Bennell & Akyeampong, 2004; UNESCO, 2014).

CHAPTER 5: Conclusions and Recommendations

The ultimate aim of TPD programmes is to increase teaching quality despite the challenges that many teachers face in difficult, rural and disruptive contexts (UNESCO, 2014). The use of OER4schools resources and the structured TPD system was designed to offer Zimbabwean teachers opportunities for peer-led teaching, collaborative learning and pedagogic reflection to enhance their classroom practice. The review of current research and literature in Chapter 1, demonstrates the strengths of the TPD framework in terms of: its school-based supportive structure, pedagogical centre, and use of technology-based resources. Yet, it also acknowledges the barriers and complexities surrounding TPD programme implementation in SSA conditions.

The evidence presented Chapter 4 of this thesis implies that there has been a notable shift in the Zimbabwean teachers' beliefs and knowledge towards a more interactive pedagogy to enhance student learning (4.1) [10], over a relatively short timescale. Results from interactivity coding and SRI interviews demonstrated: 75% of teachers used some form of interactive practice in their snapshot lesson, and the 15% of teachers who had low levels of interactivity in their snapshot lesson were able to identify this and point to improvement in a more interactive style (4.2.1).

An effort to use a higher level of peer learning activities seemed apparent in teacher interviews and observations (4.2.2). Many teachers experimented with questioning and student selection techniques in order to increase student participation, keep students attentive and increase student engagement (4.2.3). However, teachers appeared to be limited and restricted in how they responded to student answers: there was a lack of examples pertaining to cumulative talk and expanding student answers; teachers voiced difficulty in sensitively responding to students who answered questions incorrectly; only one teacher used code-switching to help a student who did not understand a question. Teachers therefore may need further support with these high-order questioning techniques to provoke more thoughtful answers and probe students to expand on their thinking by justifying or clarifying their opinions (Hardman et al., 2009). It also suggests that teachers should be urged to use code-switching within the classroom to allow students to express themselves through a 'safe talk' to achieve greater interactive coherence (Chick, 1996). Furthermore, though the majority of teachers made efforts to cultivate a safer classroom environment and to move from less didactic and greater facilitator role, the absence of student questions exemplifies teachers need to encourage and provide space for these within their lessons (4.2.3).

Whilst teachers appear to be thoroughly exploiting their own tablets to inform, collate and organise lesson plans and content, their apparent usage of technology appeared to be less frequent within the

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[10] Each statement is referenced to and validated by a section of evidence in Chapter 4 'Findings and Discussion'

classroom. (4.3.3). Typically, teachers accounts and snapshot lessons illustrated technology being used to access worksheets for the lesson or show students content-related videos (4.3.1). Interestingly, teachers discussed how these videos had brought a greater veracity to the syllabus for the students as they could *show* rather than *tell* students about unfamiliar concepts such as rivers and tennis. However, whilst a few teachers noted how technology had the huge potential to increase student autonomy, no definite concrete examples were provided. This suggests that teachers are not yet fully exploiting the potential of the software provided on student tablets in lessons. Reasons for this may stem from the time-consuming nature of technology use (in planning and within the lesson), from students' mishandling of equipment within class or it may simply be that technology skills-sets take time to develop and teachers are still progressing (Abuhmaid, 2011; Unwin, 2005) (4.3.3). A solution to this, as one teacher suggested, is that teachers need to take time to show students how operate the devices first and also more time themselves on how to utilise the provided content. Furthermore, as the headteacher persuasively maintained, teachers need further help to systematically plan technology into their lessons in a time-effective manner (4.3.2).

Teachers perceived that a change in their classroom practices (interactive and technology-based) has led to improved student enjoyment and engagement in lessons (4.4). A few teachers verified possible impacts of this by noting the decrease in student dropout, growth in yearly uptake and increase in student grades. Moreover, a heightened collaboration between the teachers in the TPD sessions has led to development towards teacher pedagogical reflection, and some of the subsequent progressive benefits this offers for teaching – a central facet to the OER4schools ethos (4.5.1). This reflective element is also glimpsed in the SRIs where teachers were able to reason why they used particular techniques, how it benefitted their students and how they might make their lessons more interactive (4.2). Video segments are illustrated as an effective vehicle to stimulate pedagogic thinking in teaching, and therefore OER4schools should continue to utilise these stimuli within the resources.

Typical barriers and problems were raised by the teachers, including workload, large-sizes and general school congestion (Bennell, 2004). Moreover, the on-going unstable political circumstances may have influenced the teachers' motivation and negatively impacted on the sequence of the TPD sessions (4.5). Although these issues cannot be regulated, the Mpumelelo team monitor these issues through WhatsApp weekly communication so support can be provided and adjusted where possible.

The two major drawbacks of the research design used in this thesis include the lack of pre-TPD programme data and possible emergent biases in data collection. The absence of evidence for teachers' practice and perceptions before the programme means it is problematic to attest the current data as a result of the TPD - especially as "teaching and learning are influenced by a multitude of situational and contextual variables" (Guskey, 2002). However, it does appear convincing that many

of the snapshot lessons and concrete answers provided illustrate teacher moves and practices which are extremely unconventional in a Zimbabwean rural school. This also links to the statistical significance of snapshot lesson interactivity between the Facilitators and Pioneer & Teacher groups (4.2.1). As the Facilitator group had higher exposure and repetition of the OER4school materials, it implies the programme influenced the interactivity of their practice. While this may be a result of non-random assignment to treatment, it may point to a topic for interesting research on how the act of facilitating TPD sessions can enhance one's own classroom practice.

The data also risk conflict with social desirability and cross-cultural biases, whereby teachers may be presenting themselves in a more pleasing way to the researcher. Although a triangulation of data collection can mitigate these biases, and video evidence is more compelling than self-report, we cannot definitively determine how frequently teachers may use these new techniques. Moreover, as previous research demonstrates that teachers often revert back to their normal practice, especially if under pressure with exams or unsupported, it is impossible to determine whether these practices will be sustained (Cannon and Hore, 1997). Nevertheless, the lesson videos show what practice is now possible in this context.

Presently, this thesis sheds lights into a stage of development in the OER4schools TPD and accompanying technology at Mpumelelo High School, Nkayi. The records of teacher and headteacher perceptions and snapshots of practice illuminate potential strengths and areas of improvement for this programme. Yet, as the impact of TPD programmes for teachers are progressive and constantly evolving – like a 'reflective practitioner' – future research and data collection is needed to establish the long-term effects that this has on 'teacher quality'. Moreover, a research design that includes student perspectives as well as an appropriate measure to determine student progress[11], would be highly beneficial given that student learning should always remain the justification behind all TPD.

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[11] Westbrook et al., (2013) discusses that this is a research gap with many studies researching pedagogy in Global South contexts: there is a need for "both *baseline and post-tests* measuring student attainment as a result of an intervention or reform and systematic, structured classroom observation" (p.3).

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Appendices

Appendix A: Sample session of the adapted OER4school resources

UNIT~1. - Introduction to interactive teaching and the use of ICT

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"***Tell me and I'll forget; show me and I may remember; involve me and I'll understand.***" (Chinese proverb)

This is the first unit in our programme. The unit offers an introduction to interactive teaching with and without ICT. It introduces the idea of "plan-teach-reflect", as well as lesson planning to include interactive activity. The unit covers the following aspects:

- What is interactive teaching?
- ICTs in interactive teaching.
- Effective use of ICTs, including basic use of tablets, browser, and images / slideshows (also in OpenOffice Impress).

The aims of Unit 1 are to:

- understand principles of interactive teaching - with and without ICT,
- see illustrations and discuss issues involved in implementing it,
- think about changing one's own practice, and
- develop ways of working with colleagues to reflect on practice, share ideas and trial new strategies.

The unit also introduces the most significant change technique, and at the end of this unit, we look at the "Leadership for Learning"-principles.

The unit is presented here in five "sessions", each approximately two hours long (when used in a workshop setting), but you may want to divide the material to suit your own setting (see "how to use this resource" for more details).

UNIT~1.1. An introduction to the 5-day workshop

UNIT~1.1.1. Introductory Workshop OER4ZIM, 10th - 16th January (2 teachers from other schools; plus ~ 14 from MHS; not-pilot teachers)

Day	8-10 (A)	10:30-12:00 (B)	13:00-14:00 (C)	14:30-15:30 (D)
1 10th	1.1.A. (interactive teaching without ICT)	1.1B. ICT + planning (small groups)	teaching and peer observation	peer feedback on lesson observation; discussion and preparation for the next session
2 11th	1.2A.; starts with reflection of follow-up activities (includes intro to interactive teaching with ICT)	1.2B. continue with ICT skills, space for teachers to explore		
3 12th	1.3A	1.3B. additional planning (small		

		groups, includes OER search and alignment)		
4 13th	1.4.A.	1.4.B.		how to carry on at your school?
5 14th	2.1.A	2.1.B		
(6)	OER search and discussion			

1.1.A. — What is interactive teaching? An introduction to the interactive Zimbabwean classroom

Table of contents.

Contents
- 1 Introduction and ice breakers
- 2 Brainstorm on interactive teaching
- 3 Brainstorming in the classroom
- 4 Planning an activity - "activity template"
- 5 Planning a brainstorm activity
- 6 Follow-up activities
- 7 Activity template

Learning intentions and objectives.
In this session you will learn about:

- the interactive teaching technique of brainstorming, and how and when to use it in the classroom, and
- activity templates for interactive teaching techniques, and how these can be introduced alongside current lesson plans.

Success criteria.

To meet the learning intentions you will:

- plan a brainstorm activity that has the potential to generate lots of ideas,
- complete an activity template for the brainstorm activity that has a clear learning objective,
- do this activity in the classroom, and
- reflect on this activity (and revise, if necessary) to ensure maximum interaction from students.

ICT components.

There are no ICT components for this session — this will start in the next session.

1.1.A.1. Introduction and ice breakers

Welcome to the workshop!

👤 Whole class dialogue (30 min): Introduction to the programme.

Welcome to the first workshop of the OER4Schools programme. The facilitator will now guide you through some introductory activities.

As part of this, you have the opportunity to discuss

- a weekly time for the workshops,
- whether you are going to use first or second names,
- your expectations,
- whether participants need to come on time, or report in if they are ill,
- keeping a register,
- the use of the ICT equipment, and
- any other suggestions, ideas, and concerns you may have.
-

1.1.A.2. Brainstorm on interactive teaching

Whole class brainstorm (10 min) on interactive teaching. Consider the following questions:

- What is interactive teaching?
- What interactive techniques do you know?
- How often have you used such techniques?

1.1.A.3. Brainstorming in the classroom

👤 Same-task group work (5 min): Discussion in pairs about what brainstorming[(a)] looks like in the classroom. Now that we have done a brainstorm in the workshop, what does a brainstorm in the classroom look like? Do you think your students would like this activity? How could you make sure that all students get actively involved? When - at which stage of a learning process would you use brainstorming? Beginning? End? Discuss this with your neighbour.

👤 Whole class dialogue (5 min): Reporting back from the discussion. Participants briefly report back from the group work.

> Educator note
> Make sure that participants get the idea of what a brainstorm is.
>
> You do not need to go round all the groups. You can just ask whether people have more to add.

👤 Observing, thinking, reflecting (5 min): Watch video of a brainstorm. Watch the following video clip together. As you watch, think about the following:

- What are you noticing?
- At what point(s) in the lesson could this be used?
- What do you think the students are learning from this?
- How are they learning?
- Can brainstorming be used with large classes too, where there isn't time for everyone to contribute each time? How would you adapt it for this?
- What are the benefits of brainstorming?
- What makes a brainstorm successful?
- What do you think about the teacher's comment "since I want all of you to participate, no hands up, OK"?

> VIDEO
> A brainstorm naming animals
>
> A brainstorm naming animals. Start of lesson: brainstorm with unique contributions, time to think first, no hands up technique.
>
> Video/Eness vertebrates 1.mp4,
> http://oer.educ.cam.ac.uk/wiki/Video/Eness_vertebrates_1.mp4,This video is available on your memory stick in the video/Eness Vertebrates folder.About this video. Duration: 2:43 (watch on YouTube, local play / download options / download from dropbox)(Series: Eness Vertebrates, episode 01)(Transcript available here or via YouTube captions.)

This clip from a Grade 3 classroom illustrates how the teacher solicits (and records) different students' views without evaluating them.

> Educator note
> Note that the clip shows the start of a session but it can be done at any point in a lesson. It shows a brainstorm – with unique contributions – allowing time to think first, 'no hands up'[(a)] technique.
>
> Workshop participants continue with the discussion.

👤 Whole class dialogue (15 min): Discussion on the brainstorm video. Let's now discuss this. We asked some questions above, which you should now discuss.

Educator note

During the discussion, record what participants are contributing. You could do this on a piece of paper or on the board. You could also appoint a scribe who does this for you, leaving you free to manage the discussion.

Think about the best seating arrangement for a brainstorming session; what did you notice about the seating arrangement in the video?

Benefits of brainstorming include:

- giving everybody an opportunity to speak,
- encouraging students to contribute a large range of ideas,
- reducing the fear of risk taking, and
- showing respect for all participants (making sure that students do not laugh at each other).

At the end of the discussion, summarise the outcomes of the discussion, including any key points the participants have made.

👤 Observing, thinking, reflecting (5 min): Summary. Summarise, and discuss the proper meaning of what a brainstorm is. You can refer to OER4Schools/activities/brainstorming to find out more.

Educator note

Make sure that all participants understand what a brainstorm is.

What is the purpose of a brainstorm? It can have many purposes, but one purpose is that a brainstorm is a good way of finding out what they already know. So to go from the "known to the unknown".

1.1.A.4. Planning an activity - "activity template"

👤 Whole class dialogue (10 min): Discussion on activity plans. Have a brief discussion about current practice on lesson planning. Consider such things as: Where do the lesson plans themselves come from? What do you think about the activities that are being done? Can you see a way that new activities could be introduced alongside your current lesson plans? Do you foresee any difficulties in doing this?

Educator note

Discuss with the participants how they plan their lessons and how the new interactive activities that they are being introduced to can work within their current plans.

In designing 'activities', we do not aim to replace whole lesson plans. We simply try to make some activities in the lessons more interactive.

👤 Introduction (10 min) to activity templates. In this section, we consider strategies to incorporate new interactive elements in your lessons, including things you might say and do. To help you structure your planning, we provide an activity template. The template includes details of:

- what the activity is (a technique such as a brainstorm, group work, mini blackboard use, plus an activity in which it is used, e.g. "a brainstorm on what animals are found in your environment"),
- the grade,
- the subject & lesson topic,
- what the (learning) objective of the activity is (e.g. to find out what students already know about topic X),
- resources to be used (such as blackboard, mini blackboards, paper, objects, etc.), and
- how the activity is carried out.

👤 Same-task group work (10 min): Planning in pairs for activity templates. Break into pairs, and capture the activity (shown in the video above) in the activity template. Remember to include the 'no hands up[(a)]' technique - this works very well with brainstorming, but can also be used for general questioning. Introduce the "no hands up" technique slowly/gradually. Some children may be overwhelmed if they are called up suddenly, they may need some time to get used to this practice.

1.1.A.5. Planning a brainstorm activity

👤 Same-task group work (5 min): Planning in pairs of a brainstorm activity. Break into pairs, and plan a brainstorm together. The pairs should be arranged, so that it will be possible to do this brainstorm with your class (e.g. pair by grade, or pair by subject). As you plan, share your ideas with your partner as much as possible, and listen attentively to their ideas and feedback.

Here are some questions you could consider to help you plan:

- What do you need to know about students' knowledge or understanding of the topic? What will you ask them to brainstorm about?
- What will you do with the results? How will you build on that in the rest of the lesson?
- What are you teaching next week?
- What is the topic of your brainstorm?
- What makes for a good topic?

👤 Whole class brainstorm (5 min) of participant's suggestions. Pick one or two of the brainstorms that were just planned and try them on the rest of the group.

Educator note

The topic of the brainstorm needs to generate lots of ideas. Look out for topics that have correct responses and/or are narrow in scope, e.g. name the parts of a flower. This would not be a suitable topic to brainstorm, instead the topic could be 'what do we know about flowers?'. (Further questions could be asked by the teacher as the brainstorm proceeds in order to find out the depth of the students' knowledge). Encourage participants to accept all responses without evaluation, and, if possible, to make a note of them for all to see.

👤 Whole class dialogue (5 min): Discussion of the trialled brainstorm activity. Did this work? How do you know? Did everyone participate? Did you use the results for bringing the lesson forward? (Meaning not to just do a brainstorm and leave it at that, but to take the lesson forward from there - a brainstorm can be like a trigger for further action).

👤 Same-task group work (5 min): Planning in pairs to revise the planned brainstorm activity. Based on what you have learned from the brainstorm trialling activity, revise your brainstorm, making sure that you have phrased your topic in a way that will generate lots of ideas. You can do this activity in pairs, but each one of you should plan an individual brainstorm activity that you will use with your class before the next session.

End of Session

You've reached the end of the session.

w **Report questions and problems** (5 min). If there were any problems, raise them with the facilitator and post to WhatsApp.

RESEARCH ETHICS REVIEW CHECKLISTFOR FACULTY OF EDUCATION

Question: Who needs to complete this checklist?

Answer: Any student or member of staff on the Faculty of Education's payroll who is planning to undertake empirical or nonempirical research. ***Note: Do not fill in this form if you are already completing the Cambridge University Psychology Research Ethics form.***

Question: What documentation should be provided?

Answer: (a) This form, completed and signed; (b) A short summary of proposed methods (attach separately or paste into Section A) or relevant sections (only) of original proposal; (c) Copies of information and consent forms/letters for participants or those providing documents/data for your analyses. (c) is compulsory where your research involves collecting information directly from children, young people or adults (teachers, parents, school leaders, others) and is often applicable when conducting documentary or secondary data analysis.

This documentation should include evidence of attending to relevant key issues in the box below.

Key aspects of research ethics

- Are the data relevant and necessary for the particular purpose?
- What are the proposed uses of the data and how long will data be kept?
- Where will data be securely stored and who will have access?
- How will participant identities and personal information be protected?
- Does *information to participants and gatekeepers* make explicit the research focus and what their involvement entails?
- Are timelines, procedures, ethics and withdrawal of consent outlined?
- What will participants gain from the research? Will outcomes be shared? How?

Note re. EU General Data Protection Regulation May 2018. Most academic research is exempt from some sections of the European GDPR legislation, assuming it is being carried out "in the public interest". However some important conditions apply and these are detailed in the Appendix to this document. Ethical good practice remains important independent of legal requirements of course.

The Faculty's Three Stages of Ethical Clearance

Stage 1 involves you in completion of this Ethics Review Checklist. This is the first stage of three. It will help you (and others) decide to what extent you need to become involved in the second and third stages. When you have completed it you (and the Faculty) will be in a position to make this judgement. Approval by an independent 'knowledgeable person of standing' is required in all cases. Further details are provided in Section C.

Stage 2 will involve you in discussing any ethical dimensions of your research in some depth with another 'knowledgeable person of standing'; this is a very likely outcome of completing the checklist. Further details are provided in Section C.

Stage 3 will involve you in obtaining formal 'ethical clearance' through the Faculty of Education's procedures; some projects will need to proceed to this stage. Further details are in Section C.

Section A: Details of the Project

Project Title: OER Professional Development Programme – Zimbabwe

Name of Researcher(s): Hannah Walker

Position in Faculty: Member of staff / Undergraduate student / PGCE student / **Masters student** / Doctoral student / Other research student

Email address: hw463@cam.ac.uk

Usual contact address: hannahjwalker1993@gmail.com

Phone number: 07999810542

Students Only

Course of study: MPhil in International Development, Education and Globalisation

Supervisor's name: Sara Hennessy

Supervisor's email: sch30@cam.ac.uk

Supervisor's contact address: sch30@cam.ac.uk

Outline of (empirical/non-empirical) methods (staff and students)

Is a project summary or funding proposal attached which details the proposed methods?   YES/NO
If NO, please add a project methods summary paragraph here:

I will be attending a professional development programme in Nkayi, Zimbabwe to conduct the second stage of research for my MPhil project. This research will include:

1. Observe the teachers' lessons in the classroom (video)
2. Taking pictures of the school and teachers
3. Interviews with teachers and headteacher regarding their experiences and perspectives of the professional development programme (audio recording)
4. Unstructured (not videoed) observations on Teacher Professional Development Sessions

Changes to design

Do you understand that:

a) any substantive change in your research plans that would change the details appended will require you to lodge a revised summary of methods?
YES/NO

b) any substantive change in your research plans that would change your answers to any of the questions on this form will require you to submit a revised form to the knowledgeable person of standing for approval of the revised plans?   **YES**/NO

Section B: Checklist

Most of the questions on this checklist deliberately offer you just two answers ('yes' or 'no'). You will probably find that you can answer many of the questions unequivocally one way or the other. However, sometimes you may wish there was an 'it depends' response category. If you find yourself in this position, please give the answer which suggests that, at this preliminary stage, there might be an ethical issue requiring more discussion at Stage 2, and explain the issue very briefly underneath.

Code of Practice relating to Educational Research

1a. Have you read the *Ethical Guidelines for Educational Research* (2018) of the British Educational Research Association (BERA)? (if you have not yet read them, the latest version is available at

http://bit.ly/BERAethics2018)

1b. Is this Code relevant to the conduct of your research?   **YES**/NO

If you have answered 'no', please briefly explain why:

1c. Do you agree to subscribe to the Code in carrying out your own research?   **YES**/NO

2. Are there any aspects of your proposed research which, in the context of BERA's Code of Practice, might give rise to concern amongst other educational researchers?   YES/**NO**

3a. Will you be analysing an existing data set that has already been collected by someone else (i.e. secondary data analysis)?   YES/NO

b. If you answered YES: can you confirm that the data you will be using are *either*

- already available in the public domain for anyone to analyse;

or
- you have been given permission by the owner of the data set to undertake your own analysis and report the results [12]

YES/NO

4. Will you be collecting your own research data for the study (through such techniques as interviewing people, observing situations, issuing questionnaires etc.)   **YES**/NO

If you have answered NO to question 4, you may proceed to Section C and need not answer any further questions in this section.

Obtaining 'Informed Consent'

5. Are you familiar with the concept of 'informed consent'? (if you are not familiar with this concept you should first consult the following source: page 9 of the BERA guidelines above).   **YES**/NO

6. Does your research involve securing participation from children, young people or adults where the concept of 'informed consent' might apply?   **YES**/NO

Permission is likely to be needed to report any information about people or institutions that is not in the public domain, and which you have been able to obtain due to your privileged access to the research site(s) in whatever capacity. [13]

If you have answered 'yes' to Question 6 above, please answer the following questions.

---

[12] *This permission should only be given if the owner of the data can make it available for secondary analysis on the basis of the informed consent they obtained from their original participants.*
[13] *Professional work (such as teaching) can involve the collection of evidence to better understand problems/issues and to evaluate innovative practice - leaving practitioners with the question of when these activities become formal research requiring informed consent. This comment is meant to highlight how the collection of data for public reporting **beyond the institution** (e.g. **in a thesis**) should be considered as a key criterion for deciding when informed consent is required.*

7a. Do you believe that you are adopting suitable safeguards with respect to obtaining 'informed consent' from participants in your research in line with the Code of Practice? **YES**/NO

7b. Will all the information about individuals and institutions be treated on an 'in confidence' basis at all stages of your research including writing up and publication? **YES**/NO

7c.

  I. Will all the information collected about the institution(s) where research is based be presented in ways that guarantee the institution(s) cannot be identified from information provided in the report? **YES**/NO

Note: in a thesis written by a researcher about a research context where they have a publicly acknowledged role, it is difficult to disguise the identify of the institution whilst also providing the expected detail of the researcher's relationship with the research context. [14]

  II. If not, has the appropriate responsible person given approval for the research on the understanding that the identity of the institution cannot be protected in the report of the research. **YES**/NO

  III. Will all the information collected about individuals be presented in ways that guarantee their anonymity?

   Note: a person with a named role, or having a specific set of reported characteristics that is unique in the research context, cannot be assured of anonymity when the identity of the research site cannot be protected. **YES**/NO

  IV. If not, have these issues been explained to the relevant participants (and appropriate gatekeepers in the case of children or other vulnerable participants). **YES**/NO

---

[14] *At present the implicit assumption is that anonymity is always desirable*, and is always achievable. In many studies these assumptions are sound. However, a practitioner (e.g. teacher) reporting research into their own practice/institution in a thesis would normally need to be explicit about their professional relationship to the research context to give an authentic account of their research. As the staff lists of many educational institutions are in the public domain and often readily found by a web search, a thesis by a named member of staff allows the institution to be readily identified from the name of the thesis author. Given that an institution can readily be identified, this also has consequences for the degree of anonymity that can be promised to participants - for example those with named roles such as Head of Year 11, Student Voice Coordinator, Head Prefect, etc, or those identifiable from detailed reported characteristics.*

* Some institutions or participants may welcome being acknowledged by name in a thesis, and their views should be taken into account and balanced against other considerations.

7d. Will your participants be informed before the study that they may withdraw consent during the research if, for whatever reason, they felt this to be necessary?   **YES**/NO

8. The Involvement of Adults in the Research

8a. Will your research involve adults?   **YES**/NO

If you have answered 'yes' to Question 8a above, please answer the following questions; otherwise please proceed to Question 9.

8b. Will these adults be provided with sufficient information *prior* to agreeing to participate in your research to enable them to exercise 'informed consent'?   **YES**/NO

8c. Will the adults involved in your research be in a position to give 'informed consent' themselves with respect to their participation?   **YES**/N

8d. Will these adults be able to opt out of your research in its entirety if they wish to do so by, for example, declining to be interviewed or refusing to answer a questionnaire?   **YES**/NO

8e. Will these adults be able to opt out of parts of your research by, for example, declining to participate in certain activities or answer particular questions?   **YES**/NO

9. The Involvement of Children, Young People and other potentially Vulnerable Persons in the Research

9a. Will your research involve children, young people or other potentially vulnerable persons (such as those with learning disabilities or your own students).   **YES**/NO

If you have answered 'yes' to Question 9a above, please answer the following questions; otherwise move to Question 10.

In educational and social research 'informed consent' regarding access is often given by a 'gatekeeper' on behalf of a wider group of persons (e.g. a head or class teacher with respect to their pupils, a youth worker working with young people, another person in an 'authority' position).

9b. Who will act as the 'gatekeeper(s)' in your research?

Please list their position(s) briefly below and, where this is not self-evident, describe the nature of their relationship with those on whose behalves they are giving 'informed consent'. **The researcher *cannot* act as the gatekeeper** (see 9g below).

I. Teachers – for students

II. Headteacher – for students and teachers

9c. Will you be briefing your 'gatekeeper(s)' about the nature of the questions or activities you will be undertaking with the children, young people or other potentially vulnerable persons involved in your research? **YES**/NO

9d. If another person (such as a teacher or parent of a child in your study) expressed concerns about any of the questions or activities involved in your research, would your 'gatekeeper(s)' have sufficient information to provide a brief justification for having given 'informed consent'? **YES**/NO

9e. If unforeseen problems were to arise during the course of the research, would your 'gatekeeper(s)' be able to contact you at relatively short notice to seek advice, if they needed to do so? **YES**/NO

9f. Could your 'gatekeeper(s)' withdraw consent during the research if, for whatever reason, they felt this to be necessary? **YES**/NO

9g. i. Are you undertaking research into your own professional context/institution (e.g. with students in a school where you work)? YES/**NO**

If you answered 'YES' then you should identify (in 9b above) a suitable senior person who has agreed to act as an independent point of contact for participants to act as the gatekeeper, and answer the following two questions:

ii. Will you ensure that other people in the research context are aware of the identity of the gatekeeper? **YES**/NO

iii. Will you take reasonable precautions to ensure that research participants (and where appropriate their parents/guardians) know that they should contact the gatekeeper (and not you) if they have any concerns about the research? **YES**/NO

Other Ethical Aspects of the Research

10. Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g. covert observation of people in public places)   YES/**NO**

11. Will the research involve the discussion of topics which some people may deem to be 'sensitive'? (e.g. sexual activity, drug use, certain matters relating to political attitudes or religious beliefs)

YES/**NO**

12. Does the research involve any questions or activities which might be considered inappropriate in an educational setting?   YES/**NO**

13. Are drugs, placebos or other substances (e.g. food substances, vitamins) to be administered to study participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind?   YES/**NO**

14. Is pain or more than mild discomfort likely to result from the study?   YES/**NO**

15. Could the research involve psychological stress or anxiety or cause harm or negative consequences beyond the risks encountered in normal life?   YES/**NO**

16. Are there any other aspects of the research that could be interpreted as infringing the norms and expectations of behaviour prevailing in educational settings?   YES/**NO**

17. Are there any other aspects of the research that could be to the participants' detriment?   YES/**NO**

18. Will the study involve prolonged or repetitive testing?   YES/**NO**

19. Will financial inducements (other than reasonable expenses or compensation for time) be offered to participants?   YES/**NO**

Section C
What Further Steps to Secure Ethical Clearance are Required?

Stage 1 Clearance
Interpretation of Results

If any of your answers coincide with <mark>the response options having a coloured background</mark>, then please add details of your plans under relevant items (or refer to specific sections/pages of your proposal). In this case you should assume that further discussion involving Stage 2 procedures is required because some aspect of your proposed research is likely to be 'ethically sensitive'. In practice, many issues can be resolved at this stage.

Members of staff should be especially careful about research involving their own students (question 9g).

*If you have ticked 'yes' in response to one or more of questions 10 to 20, both Stage 2 **and** Stage 3 clearance will definitely be required.*

Stage 2 Clearance

Any 'ethically sensitive' responses identified by the researcher during completion of the form or subsequently by the knowledgeable person (see below) should be discussed in detail before the form is signed.

Stages 1 and 2: Approval

<u>All</u> researchers need to have this form approved and signed by a 'knowledgeable person of standing'. That person should first raise with the researcher any queries or concerns they have, even where the researcher considers that Stage 1 clearance is sufficient. S/he should also review the additional documentation provided and suggest modifications if needed, before giving approval.

In the case of *students* within the Faculty, this person will, in almost every case, be the person supervising your research.

Members of Faculty *staff* will need to exercise some care in selecting such a person. S/he is likely to be someone with considerable experience of research in a cognate area to your own and quite likely to be one of the more senior members of the Faculty. S/he should not be someone who is also involved in the research nor someone with whom you regularly collaborate (whether in relation to research, teaching or administration). The test, in every case, should be whether an outsider would judge the person chosen to be 'independent'.

On completion of the discussion, the 'knowledgeable person of standing' is asked to choose one of the following three responses, to delete the other two and to affirm their views by adding their signature.

a) I have discussed the ethical dimensions of this research and, as outlined to me, I do not foresee any ethical issues arising which require further clearance.

or

b) There may be some ethical issues arising from this research. I think it would be prudent for the researcher to seek further advice and, possibly, Stage 3 clearance.

or

c) Ethical issues arise in this research which require further discussion; my advice is that Stage 3 ethical clearance should be sought.

and

I have reviewed the summary of proposed methods and any consent/information sheets provided and hereby approve them.

Name: . . . . .Sara Hennessy . . . . Date of discussion: . . . . . 27.02.19 . . . .

Signature of 'knowledgeable person of standing' . . . .   *Sara Hennessy*   . . . .

Lodging this form

It is your responsibility as the researcher to lodge this form with the appropriate body *well in advance of undertaking your research*.

Students should provide their supervisors with a copy that can be lodged with other papers their supervisors are keeping about their work. If Stage 3 clearance is required, supervisors will take steps to initiate these procedures. Approved ethics forms are routinely required to be submitted with doctoral registration reports and with final theses for all postgraduate students.

Members of staff should lodge a completed copy of this form with the Faculty Research Office. They should draw attention, albeit briefly in the first instance, to the nature of any outstanding issue(s). The Director of Research will then advise on the appropriate Faculty procedures to be followed to enable the research to be considered for **Stage 3 clearance**.

All researchers should be aware that Stage 3 discussions could involve them in making modifications to their research design or proposed procedures and may, in certain circumstances, result in ethical clearance being withheld.

Teachers watch the video stimulus of their recorded lesson just before the interview

1. How long have you been teaching for?

Questions specific to the observed lesson

2. What do you think are the main strengths of this lesson?
3. What student learning do you think took place in this clip?
4. Did you try any new teaching techniques that you learnt from the professional development program?

   *** Approximately three/four questions are asked specific to the lesson,

   EXAMPLES

   - *Why did you get the students to recap the lesson rather than doing it yourself?*

   - *Why did you often pick on the students at random rather than relying on hands up?*

   - *Why do you get the students to write their answers on the board?*

   - *What did you use the iPads for?*

5. Is there anything you would change if you were to teach this lesson again and why?

Interactive teaching

6. How would you define interactive teaching?
7. Can you give some examples of activities that are interactive?
8. How do you think interactive teaching can impact on student learning and outcomes?
9. How often do you use interactive teaching methods in your classroom: daily, weekly, monthly?
10. Can you give me a specific example of when you used an interactive teaching method and what the outcomes were?
    - Probe for concrete examples.
    - Probe for impact on student learning.

Technology

11. Has technology changed the way you plan and teach your lessons?

12. How often do you use technology in the classroom: daily, weekly, monthly?

13. Can you give me a specific example of when you used technology and what the outcomes were?

- Probe for concrete examples.
- Probe for impact on student learning.

The Teacher Professional Development Programme

14. What do you think have been the strengths of the professional development program?

15. What is the one key thing you have learned from the professional development program?

16. Have there been any challenges regarding the professional development program?

17. Is there anything you can think of that would improve the program better or that could be added?

18. Is there anything else you would like to add, or any questions you would like to ask me?

History and background of the Teacher Professional Development Programme

1. What is the background of this programme?
2. How long has it been running for?
3. Why did it start and what was your initial involvement?
4. What interventions have been implemented over this time?

Benefits and Challenges

5. Which interventions have been the most helpful and why?
6. Which interventions were not as helpful?
7. What have been the major challenges with this programme?
8. Is there anything that you think could be improved? Is there anything you think should be added?

Impact of the Programme on teachers/students

9. What impact do you think these interventions have had on the practice of your teachers?
10. How far do you think the teachers implement interactive teaching methods in their lessons?
11. How frequently do you think the teachers use technology within their lessons or to help the students' learning?
12. Can you give me a few examples when you have seen teachers implement these strategies?
    - Probe for concrete examples.
    - Probe for impact on student learning.

Interviewer 0:00
How long you been teaching for?

Abel 0:05
Almost two years

Interviewer 0:14
What do you think are the main strengths of this lesson?

Abel 0:21
The students getting involved with the lesson and I not dictating everything.

Interviewer 0:41
What student learning do you think took place in this clip?

Abel 0:53
Firstly, what are fractions And then how to change other factions into percentages. We didn't get enough time to get to know if all of them had understood. (.)Also, the time frame.
I would like to mark the exercises to to see which students face challenges. If they face challenges, then I would know that they had problems. Initially in the lesson, I did notice that other people's we're not working. I noticed that most were involved. And most were because I was asking them to take part. So they were involved.

Interviewer 2:01
Did you try any new teaching techniques that you learnt from the professional development program?

Abel 2:08
In this lesson, yes, the interactive part. That is mainly that I wanted the interactive part mainly the iPad, was at the end of the lesson that was used in the lesson. And generally asking them questions. So getting them involved. And, and also at the start of the lesson
I would say I use what I learned.

Interviewer 2:47
Great, I'm now going to ask you a few questions that are specific to the lesson. Why did you get the students to recap the lesson rather than doing it yourself?

Abel 3:03
Recap? Usually, it's a way of maybe it's a way that I used to maybe analyse whether they are still familiar with what we did yesterday, so that so that when we proceed so that when we proceed without the problems, and they show problems with their recap, (.) then I will know that I don't have to go much farther than the problems they face in the previous lesson.

Interviewer 3:46
Why did you often pick on the students at random rather than relying on hands up?

Abel 3:56
Usually relying on hands up you're concentrating on one, I can say the high achievers.
So I want to know, even though the slow learners if they actually got something from what they

learned about, but if I pick just those whose hands are up the yeah the lesson will be some kind of biased. Because I'll be picking only on those high achievers.

Interviewer 4:38
Why do you get the students to write their answers on the board?

Abel 4:51
I do it for their confidence. Just to show them that mathematics is simple. That they can also do it themselves. And they don't have to rely on the teacher ## For their peers, the ones who see this, the other students writing on the board.

Interviewer 5:26
How do you think that might help their learning?

Abel 5:26
Okay (.)I think it develops their confidence building. Because they realized that if my colleague can actually put his or her answers on the board, I can also do that. So next time I teach them, everyone will want to be involved.

Interviewer 5:47
What did you use the iPads for? And how do you think this helps your students learn?

Abel 6:01
iPads are new unlike the textbooks that everybody has, the textbook does not invoke any kind of interest in the lesson. But if you use an iPad, even if it has the same exercises on it as the textbook, it actually creates interest amongst the peoples. Because everybody wants to see what's on the iPad, they want to zoom in and zoom out and see. Yes, it builds interest.

Interviewer 6:33
Is there anything you would change if you were to teach this lesson again and why?

Abel 6:42
Change? I think I would move around more. And also see that they are paying attention to see if all students were looking, because I see on the clip that some students looking back and looking at the camera when I was teaching,# also maybe I can teach a few of them how to operate the iPads. Because I had to go around and realize one of the iPads that actually went off. And one of the students was in a snapshot I'd taken rather than opening the right work. I should do a lesson on how the iPad can be used.

Interviewer 7:27
Is there any other technology or resources that you would have used that you think would have improved this lesson?

Abel 7:36
Maybe a projector? Yeah, maybe a project to but the iPad was okay.

Interviewer 7:46
How would you define interactive teaching?

Abel 7:51
Interactive teaching is (.) is an interactive way of lesson delivery. Or yeah, some way of student

learning whereby the teacher is just facilitating. You are not feeding them with answers. You are probing them to come up with what they think you are just a guide.

Interviewer 8:28
Can you give me examples of activities that are interactive?

Abel 8:34
I'll give you an example using the lesson I got them to come and write down what he she thinks is a percentage in his or her opinion. So yes # basically, I want people's to personally express themselves what they know about a certain concept.

Interviewer 9:01
How do you think interactive teaching can impact on student learning and outcomes?

Abel 9:08
Learning becomes inevitable. If a student is told, they only know the concept for the exam. But interactive teaching promotes longer learning. So they can use it even further in life.

Interviewer
How often do you use interactive teaching methods in your classroom? Daily, weekly, monthly?

Abel 9:40
I would say weekly because of maybe pressure to finish the syllabus which can naturally effect but yeah, weekly.

Interviewer 9:52
Can you give me a specific example of when you used an interactive teaching method?
And also not from the clip we've just seen but another time, and what the outcomes were?

Abel 10:07
Usually the A Levels usually the A Levels are just give them a concept. And then just last week, on a Friday, I'm not sure I gave them a certain concept, statistics concept, I get them to write their assumptions. And then one continues on one continues after that, and then they finish the whole problem. And then I pinpoint where there are areas where maybe there are additions. And I assist. And then from that I've introduced the main topic about that significance testing. What's the direction today I talked about certain concepts, which then relate.

Interviewer 10:51
And how do you think the students learn better using this method?

Abel 10:56
Ah, they learn better actually is different from the lecture, lecture is boring.
Whereas with this, they actually get to get involved. whatever they're working out, it becomes practical. It becomes relevant.

Interviewer 11:16
Has technology changed the way you plan and teach your lessons?

Abel 11:26
Yes, it's changed. It's changed, it's given them a new. There's so much through laptops, you can research with some of the textbooks if we just rely on the textbooks. Most the textbooks that are using

the school, they are out of date 1970 for example, they are not in line with (what is happening currently). So technology has improved the fact that I am current with what I am teaching, so no 20th century questions unlike the previous textbooks.
It makes them current.

Interviewer 12:08
How often do you use technology in the classroom: daily, weekly, monthly?

Abel 12:12
depends on the type of technology say if it's projector, maybe maybe save say once a month maybe. Because maybe there are a few all of us who want to want to use the same projector. Though we need to make time for each other with iPads on a daily basis. There is a provision for teachers to use them to access them so they can't so depends on what kind desktops we use them almost on a day to day basis.

Interviewer 12:55
Can you give them an example of when you have used technology in the classroom and the outcomes for the students?

Abel 12:57
I can't say I haven't explored all the technology options (.) (.) say the projector.

Interviewer 13:04
Can you give me an example of when you have used the projector?

Abel 13:08
I know rarely. See, usually it's used by somebody else.

Interviewer 13:22
Can you give me an example of another time you have used technology and the impact it has on student learning?

Abel 13:22
I can't tell you the specific date but specifically I use iPads I prefer them. It makes things simpler. Videos and stuff especially for the A Levels. I say Guys, can you just watch this and then they can start interacting. Basically, they're not boring and it's a change. There's a change from textbook textbook textbook textbook. And if they get to learn from another individual from the video besides me, I think it's better than hearing something from the same mouth all the time.

Interviewer 14:04
Okay, thank you. Now I'm going to ask you questions about the professional development program in general. What do you think have been the strengths of the program?

Abel 14:12
The strength (.) the strength of the program. I can say one of the strengths of the program is
they help teachers to link the iPad and also also the phone to the projector or even the iPad to the projector, and even basically the use the projector.

Interviewer 14:47
What is the one key thing you've learned from the professional development program?

Abel 14:51
One key thing, pupil's learn more from interaction than simple lectures and attendance improves with interaction.

Interviewer 15:01
Have there been any challenges regarding the professional development program?

Abel 15:15
maybe it's me personally may be one the delay of guessing the gadget the delay getting your tablet yes getting the tablet because because I came late and I was the last person at the programs and all the other teachers already having them

Interviewer 15:24
Is there anything you can think of that would improve the program better or that could be added?

Abel 15:29
Maybe more projectors ## Yes, just that.

Interviewer 15:32
Is there anything else you would like to add, or any questions you have for me?

Abel 15:41
No, I don't think.

Abel 15:43
That's the end of my questions. Thank you for taking part.

Appendix F: Mapping and grouping further categories in transcript coding process

ICT: inside and outside the classroom

For student work and in-class learning: students can research on their own (9); videos (7); student use of tablets to type up coursework and tests (4), teacher can send notes to student tablets (3); projecting an image (3); apps (2)

To plan and research lessons: To help teacher creating lesson plans (6); teacher researches content for lesson (3)

Questioning

Questioning is more considered, interactive, inclusive and experimental: picking students at random (5); brainstorming (5); mute chalkboard approach (3); probing students through questioning (2); accepting an incorrect answer (2); magic mike (2); open and deep questioning (1); Giving students wait time (1); Teacher can monitor student progress and increase accountability for students (5);

Peer learning activities

Increase in peer to peer learning activities: group work (9); think, pair, share techniques (4)

Less teacher-talk, and more student-talk/student-dominant activities: Shift towards more student involvement and control (7); student presentations (6); students writing their answer or opinion on the board (4); decreased teacher talk (3) class discussion or debates (2); less pressure for the teacher to talk all lesson (1)

Classroom Environment

Generally greater student participation (8); shy students participate more (7); students learn from each other (6); lower attaining students participate more (4); students and teachers are learning and working together (3)

Miscellaneous

School reputation has been enhanced (1)

Did not like the maths app in TPD session (1)

Collaboration

The sessions have bonded the teachers (2); Teachers share ideas and help each other (4)

Contextual issues

Access to equipment: Equipment being used by another teacher / shortages (4), the teachers who have the key to the computer lab are not around (1); very difficult to get access to a projector (1)

Faulty/ missing equipment: no chargers (2); delays of receiving equipment (2); the charge of the tablets goes down quickly (1); difficulties with the Moodle (1); difficulties with the modem (1); power cuts (1)

Challenges with students: Incorrect student handling of equipment in class / they don't know how to use it (4); need for students to research before the lesson/ take the tablets home (2); big classes (1)

Political situation (1)

Student learning

Students can research on their own (9); There is longer lasting learning and a deeper understanding (6); students learn more (5); students are more focused (3); things become simpler and easier to understand (2); students will answer questions with more reason and ideas (2); students got better grades than was expected (1); students' English language and communication skills are enhanced (1).

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Appendix G: Sample of interactivity coding from a snapshot lesson

Teacher : Tania	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6	Segment 7	Segment 8	SUM and proportion
SEGMENT DESCRIPTION: group work (GW), Student presentation (SP), Whole class questioning (WCQ), Teacher explanation (TE), Individual work (IW), Use of tech (TECH)	WCQ +TE+: Define MNC	GW: to discuss in pairs	WCQ: feedback of pair discussion	TE	WCQ	IW- write four disadvnatges of MNC	SP students share their points	WCQ +TE	
TIME:	0:00	00:01:34	00:04:15	00:06:22	00:07:21	00:11:21	00:13:46	00:16:06	00:18:14
Timing per segment:	00:01:34	00:02:41	00:02:07	00:00:59	00:04:00	00:02:25	00:02:20	00:02:08	00:18:14
ONE: Student involvement/ participation		1	1		1		1		
TWO: Length of student contributions		1					1		
THREE: Cooperative learning									
FOUR: Teaching moves that encourage student interaction and student participation	1	1	1		1				
FIVE: Teaching moves that indicate teacher facilitation and guidance	1				1				
									Indicator proportion score (%):
Total indicators per segment	2	3	2	0	3	0	2	0	35.19195612

OVERALL LESSON DESCRIPTION	
Topic, learning objectives:	Economics - Multinational Corperations
Number of students in classroom:	4
General account of activities:	All students participate in the recap. They are put into pairs to discuss ideas which is then fedback in the classroom. The teacher picks on students at random and once probes a student answer (Segment 5 - 'why'). Students work individually and then one-by-one present their answers to the rest of the class. More questions are asked, and the homework is set.
Highlights:	High variety of tasks and levels of student participation. Open questions are asked, and students are selected at random.
Challenges:	Teacher does not engage with student answers in much depth despite the small class number