

EXPERIENCES IN THE CONSTRUCTION OF RESEARCH INSTRUMENTS FOR MATHEMATICS TEACHER PROFESSIONAL DEVELOPMENT

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ABSTRACT-The “*Analyses of Mathematics Teacher Professional Development Programmes (MTPDP) in selected developed and developing countries: Insights for quality mathematics instruction in sub-Saharan African countries*”, is a caption given to a cross-continental collaborative study initiated by the Department of Mathematics Education, at the University of South Africa. The study aims to investigate the impact of MTPDP initiatives on the quality of teacher pedagogy and students’ performance. The study is an exploratory mixed-methods design involving 11 countries to facilitate the sharing of ideas and a collective reflection on MTPDP activities. The development of data collection instruments was a collaborative effort to probe high school mathematics teachers, school principals, service providers, district officials and subject advisers on MTPDP-related issues. The MTPDP pilot study, which is reported in this paper, aimed: (1) to assess the efficiency of MTPDP data collection instruments; and, (2) to address logistical and methodological issues relating to the MTPDP study. The pilot study highlighted the value of gathering information prior to a larger study to enhance the research design of the latter. Specific lessons acquired from the pilot experience will help to construct effective operational conditions for the main study.

Keywords: Mathematics teachers; Professional development programme; pilot study.

1. INTRODUCTION

The dawn of democracy in 1994 has initiated a wave of unprecedented curriculum reforms in South Africa. In almost all reform initiatives teachers are considered the main agents to influence and facilitate the intended curriculum change (EL-Deghaidy, Mansour, Aldahmash& Alshamrani, 2015; King & Newman, 2001; Mashile, 2002; Steyn, 2008; Wanzare & Ward, 2000). According to King and Newman (2001), teachers have the most direct, sustained contact with students as well as considerable control over what is taught. In the context of South Africa curriculum reforms require teachers to adopt upgraded and updated forms of subject content knowledge and appropriate strategies to teach it. The need to reform the education sector opens opportunities to initiate professional development programmes (PDP) for teachers in almost all school subjects. The literature casts a wide net for what constitutes PDP activities. Little (1987) describes PDP as “any activity that is intended partly or primarily to prepare paid staff members for improved performance in present or future roles in the school districts” (p. 491). According to Mansour, Albalawi and Macleod (2014), PDP initiatives must be based on the idea of lifelong learning for teachers.

With this demand several role players are entering the PDP space with a variety of interests and agenda. This has made it difficult to gauge the success and efficiency of many PDPs within an educational setting. For instance, the success and efficiency of some of the PDPs have been measured on the number of official workshops that are generated or the number of participants that a PDP draws, rather than mediating evaluation indicators in terms of the impact of programmes in classrooms or schools (Steyn, 2008). One could argue that PDPs are failing to fulfil their mandate to help teachers to improve classroom practice and elevating learners’ performance. Given this background, it may be difficult to provide suitable answers to questions such as: (i) what is the definitive status and agenda of PDP initiatives for teachers in the South African contexts?; (ii) what role do the PDPs play in reshaping the educational landscape of South Africa?; (iii) how can we best measure the PDPs in South Africa?; and, (iv) what should be the characteristics of high-quality PDPs?

These questions are not necessarily answered in this paper.

Most teachers in South Africa are not adequately qualified to teach mathematics (Mashile, 2000; Ono & Ferreira, 2010; Steyn, 2008). The national policy framework for teacher education and development is a state-mediated initiative to address classroom issues of the quality of teachers' qualifications (South Africa, 2007). To achieve this mandate the government relies on the influence and role of PDPs to strengthen teachers' content and pedagogical knowledge. Steyn (2008) argues that most of the PDPs in South Africa have degenerated into nothing more than a "state-funded skills development programme" (p. 17). An effective PDP should strive to awaken awareness of one's inability or incompetence to perform according to one's own expectations or laid-down criteria (Steyn, 2008). Therefore, PDPs should not only be perceived as vehicles to train teachers to implement new governmental policies, but also as preparing teachers to improve their classroom practice.

Different models have been suggested to train teachers in South Africa. Prominent amongst them is a "cascade" model (Ono & Ferreira, 2010, p. 59). In a cascade model a small group of teachers is trained with the hope that they will later cascade or filter down the new knowledge to their colleagues. In this arrangement a cascade model could be a cost-effective developmental activity. However, several concerns have been levelled against this teacher development model with others raising concerns that by the time the knowledge reaches the lower levels of teachers, it is possibly watered down or misinterpreted (Fiske & Ladd, 2004). In some instances those who initially provide new knowledge to the first group of teachers have been accused of lacking the required expertise to train teachers. In another model situated and cognitive views of learning as interactive and social have recently been applied to teachers (Desimone, 2009; Greeno, 1997). Within this conception the notion of a lesson study presupposes that formal and informal learning communities among teachers can act as powerful mechanisms for teacher growth and development. A lesson study is a Japanese popular version for teacher development initiative.

In a lesson study model a few teachers develop themselves in a classroom using their lessons and this happens in a context of a single lesson where a group of teachers observe a lesson delivered by a colleague (reference). They document their observations in a report and later discuss them as a group, and further suggest areas of improvement for a future lesson. The benefit of school-based PDP initiatives through lesson studies in Japanese schools has been an improvement in the quality of teaching and learning. Although some researchers have conducted studies on the effects of a lesson study model, and subsequent benefits, the lesson study does not form part of recognised PDP initiatives in South Africa (Ono & Ferreira, 2010). It must however be noted that the recognised PDP models in South Africa have seemingly fallen short in elevating the quality of teaching and learning (see, Luneta, 2012). Therefore there is a need to find ways to examine various PDPs in South Africa in terms of: (1) their impact on the quality of teacher instruction and students' performance; (2) the implications of their delivery modes in relation to their observed outcomes; and, (3) the logistical issues regulating their model of implementation. It must be noted that Luneta (2012) provides an extensive literature review on the status of teacher PDP programs in South Africa. According to Luneta (2012), the purpose of PDP should be to "enhance the quality of students' learning by improving the quality of teaching through constant review and assessment of teachers' instructional approaches, identifying the effective teaching approaches and capitalising on them for the benefit of the learners (p. 362).

Informed by these observations the Department of Mathematics Education (DME), at the University of South Africa (UNISA), launched a research initiative to explore the status and the nature of PDPs in South Africa. As a training unit DME has a statutory mandate to improve the quality of mathematics teachers in the country. The study initiated by DME, namely, an *Analyses of Mathematics Teacher Professional Development Programmes (MTPDP) in selected developed and developing countries:*

Insights for quality mathematics instruction in sub-Saharan African countries, is a cross-continental collaborative mathematics education research involving 11 countries. It is hoped that the outcome of MTPDP study could inform the design of teacher programmes that the DME is currently offering. Participating in the MTPDP study are seven countries from the African continent (six from Sub Saharan Africa and one from North Africa). Countries from Sub Saharan Africa are *Botswana, Namibia, South Africa, Swaziland, Zimbabwe* (South African region), and *Tanzania* (East African region). The North African country is *Morocco*. The following developed countries are participating: *Singapore, South Korea, Ireland* and *Poland*. The objectives of the MTPDP collaborative study are spelled out as follows:

to examine the Mathematics Teacher Professional Development Programmes (MTPDP) of countries in international systemic assessments and professional development programmes;
to learn from exemplary practices of MTPDP in use (from countries in the sample) in efforts to improve mathematics teacher development programmes in these countries;
to propose a systemic and nationwide improvement of mathematics teacher professional development programmes for South Africa and other participating countries; and,
to facilitate the sharing of research skills and output, networking and forming partnerships in relation to the execution of MTPDP activities.

Given the set of objectives for the study researchers from participating countries have frequently assembled to develop data collection instruments. The target groups for data collection are *mathematics teachers, school principals, district officials, subject advisors* and *MTPDP service providers*. Data collection instruments include a questionnaire for teachers and interview schedules for other groups of participants. Instruments are designed to address pertinent MTPDP issues considered to be common in all participating countries. Instruments have been tailored to suite the context of each country where they are administered, but also ensuring that the items are parallel in each instrument type for comparison of study findings across countries. This paper aims to report on a pilot process that preceded the actualization of the main study. This paper therefore reflects on the experiences of the DME researchers while testing the MTPDP data collection tools in South Africa. I begin the paper by providing some background on the value of pilot studies in research.

2. THE ROLE OF PILOT STUDIES IN RESEARCH

All researchers are aware of the potential challenges they often face when setting up a research project. Some of these challenges may include studying issues that researchers have “minimal tacit, intuitive, or experimental knowledge on” (Kezar, 2000, p. 385). In that way a pilot study becomes the first step of the practical application of the main or actual study, thus providing an avenue to address and deal with the challenges before they could present themselves in the main study. Therefore a pilot study forms a critical component of the research process. A pilot study could be conceptualized as a methodological preface to the main study. It can be described as a mini version or a trial of a full-scale or main study (Gay, Mill & Airasian, 2011). A pilot study may help the researcher to gain greater understanding of the issue to be researched and further enhance the research design, conceptualization, interpretation of findings, and ultimately the results (Kezar, 2000).

There is a paucity of literature providing useful insights on the guidance and rationale for conducting pilot studies (Gardner, Gardner, MacLellan & Osborne, 2003). However, the available literature acknowledges that pilot studies are important for a range of specific reasons. Henk (1987) noted that “there is no question that the methodology of an investigation can be enhanced considerably by conducting pilot studies” (p. 66). Gardner *et al.* (2003) conducted a pilot study to strengthen the methodological component of the main study. In their description of the pilot process they noted, “This is a methodological study in which a case report is used to retrospectively analyse the link between a successful pilot study and stalled main study to identify potential methodological

weaknesses in the planning process” (p. 719). The findings of Gardner *et al.* (2003) revealed that the pilot phase is a significant process in research planning to enhance the design and operational make-up of a study.

The Forgasz and Kaur (1997) study provides another dimension to illuminate the value of pilot studies. Forgasz and Kaur (1997) conducted three pilot studies in which the first pilot study (Study A) was used to trial the administration of a self-report questionnaire, and further analyse questionnaire responses. The questionnaire was designed to provide indications of students’ likely levels of engagement in autonomous learning behaviour during Grade 7 mathematics lessons (Forgasz & Kaur, 1997). The items in the questionnaire required students to rank the questions from easiest to hardest, and to further provide reasons for their responses. The students were also to indicate the questions they would attempt during the course of a mathematics lesson, and which single question they would choose to do in a test (Forgasz & Kaur, 1997). Study A (pilot 1) results highlighted a need for minor revisions in the questionnaire. The pilot process revealed that: (1) the instructions in the questionnaire were not clear; (2) some of the mathematics in the questionnaire were confusing or ambiguous; and, (3) there were typographical errors in certain sections of the questionnaire.

Study B of Forgasz and Kaur (1997) study comprised five Grade 7 students working in a small group on non-routine co-operative mathematics task. The component of qualitative data collection in this setting entailed the use of a video-recording device. The use of pilot study provided the researchers with experience in using a video-recording facility in research. Both the potential of a video-recorder and its limitations were illuminated in the pilot process (Forgasz & Kaur, 1997). Study C (pilot study 3) helped researchers to amend the methodology of the main study (Forgasz & Kaur, 1997). These studies highlight the value of pilot studies in improving the design and other aspects of the main study.

3. THE MTPDP PILOT STUDY

DME researchers played out a South African version of the MTPDP pilot study to establish the parameters and operational standards for the main study. The objectives of pilot study were to:

test the appropriateness of all data collection instruments;

trial the validation process of data collected from various instruments, and also from various groups of study participants;

experience and gain insights into the operational process of the study; and,

enhance the methodological make-up of the study.

According to Lancaster, Dodd and Williamson (2004), a clear list of objectives may add to a methodological rigor of a pilot study. The four objectives of the pilot study relate to the research process, that is, how to operationalize the methodological plan of the study, rather than focusing on the research outcome. This approach largely influenced our treatment of the outcome of the pilot study, and further ensured that the research process in the main study is modified. Using this approach, researchers anticipated that the problems, probably identified in the pilot study, would be avoided in the main study.

4. THE METHODOLOGY

In this section I discuss issues relating to operationalizing MTPDP pilot study in South Africa.

4.1 The research design

Given that one of the objectives of the pilot study was to address the operational aspects of the MTPDP study, the pilot process followed the methodological framework established for the main study. The study falls within a sequential exploratory mixed-methods design consisting of a dominantly

qualitative component (see, Creswell, 2013; Creswell & Clark, 2007; Creswell, Plano Clark, Gutmann & Hanson, 2003). This type of a mixed methods design may be represented by the following procedural notation, “the QUAL-Quant model” (Gay et al., 2011, p. 484), suggesting that the methodology is primarily qualitative with a lesser emphasis on the quantitative component of data collection (Creswell, 2013; Creswell et al., 2003). The qualitative data is collected first, followed by collection and analysis of quantitative data. The purpose of a sequential exploratory mixed-methods design is to develop an instrument (such as a survey), to develop a classification for testing, or to identify variables (Creswell, 2013). This design fits the requirements of a pilot paradigm in which initial research is conducted to clarify and define aspects of the main study (Creswell & Clark, 2007; Gay et al., 2011). An exploratory design is flexible and could be described as the front end of the intended study (Gay et al., 2011). The MTPDP study is a collaborative initiative following a cross-continental comparative approach in 11 countries to facilitate the sharing of ideas and a collective reflection on MTPDP activities in participating countries. In the context of South Africa the exploratory design assumes an interactionist perspective to enable researchers to establish the nature of MTPDPs in the country.

4.2 Participants

The sample for the pilot study comprised 51 participants consisting of *high school*¹ mathematics teachers, high school principals, subject advisers, District Directors, Heads of Department (HoD) in education and PDP service providers. Table 1 shows the ratio of male and female participants to be about 1:4, i.e., 37(72.5%) were males and 14(27.5%) were females. The sample was purposively chosen on the bases that they each played a part in facilitating the teaching and learning of mathematics in the high school setting.

4.3 Ethical considerations

Ethical clearance for conducting both the pilot study and the main study was obtained through our institutional ethics committee and all suitable consenting participants were recruited into the pilot study.

4.4 Instruments

The development of all data collection instruments was a collaborative effort by all participating countries. The instruments were developed to address common issues in relation to MTPDP activities in 11 participating countries. However, it was agreed that the pilot process would allow each country to align instruments to local contexts.

4.4.1 Teacher questionnaire

A self-report questionnaire, which consisted of two sections, was developed for teachers. Items in the first section of the questionnaire addressed teachers’ demographical issues, and probed them on the following variables: *gender; number of years teaching mathematics; highest qualification in mathematics; number of MTPDPs attended; post level status in a school;* and so on. All items in the first part of the questionnaire were meant to enrich and complement data in the subsequent section by providing a relevant contextual profile of participants to give meaning to the data in the second part of the questionnaire. The second part of the questionnaire probed teachers on their experiences, encounters and opinions on the MTPDP activities. Some of the items in this section included, *In which way did your participation in professional development programmes influence your professional practice? Are the MCPD activities included in the school policy,* and so on?

4.4.2 Interview schedules for other participating groups

The questionnaire was only administered on teachers. All other participating groups were interviewed on MTPDP in terms of their roles and influence on mathematics teacher development (11 school principals; nine subject advisers; nine District Directors; four HoDs for education; and, one service

¹. In the South African context, the term *high school* covers the grade levels from Grade 6 to Grade 12.

provider). Principals were probed on the role they play in the planning and facilitation of PDP activities in their schools. Questions in the principal category included: *Are continuous professional development activities included in the school policy?; What kind of support do you have for the facilitation of the MTPDP in the school?; etc.* The subject advisers' tool entailed items such as: *Do you think the implemented MTPDP at school improve the teaching in the school? What kind of support do you give for the facilitation of the MTPDP in the school? What do you consider to be the strengths and weaknesses of the MTPDP at the school?*

The district officials who participated in our pilot study were mainly District Directors who are normally in charge of a certain number of schools in their jurisdiction, and they form part of an official protocol structure in their designated areas. When constructing the data collection tools for this group we anticipated that their PDP roles could be located within the following activities: (1) setting up selection procedures for PDP service providers (*What criteria do you use to select the providers of the MCPD programmes?*) (2) developing an inventory of PDP service providers in the district (*What kind of MCPD do you provide for mathematics teachers in the district?*) (3) influence on the timing for the rolling out of PDP (*When are the MCPD programmes conducted?*) (4) provision of PDP evaluation and monitoring mechanisms (*How do you evaluate the MCPD providers? How do you monitor the MCPD providers?*) (5) establishing accreditation and appraisal mechanisms (*Do the programmes lead to some form of certification?*) etc.

The service providers' tool addressed issues regarding the availability and adherence of state policies regulating PDP activities in South Africa (*Is there a general policy on continuous professional development for teachers in this country? If Yes, who formulates this policy?*) The influence of such policies (in case they existed) on PDP formulation and implementation (*What is the influence of the existing PDP policies on your MTPDP activities?*) The design and implementation features of MTPDP (*What strategies do you use in developing the MTPDP? How are the MTPDP conducted?*) The mode of MTPDP delivery (*When are the programmes conducted?*); etc. In essence, all items in the parallel interview schedules were designed to address various MTPDP activities at different levels of implementation. However, the collective objective of instruments was to determine the nature of MTPDP in South Africa, and the views the role players have on the influence the MTPDP have on teachers and the students.

4.5 Preparation of the pilot study

The plan was to conduct the pilot study in all nine provinces of South Africa. However, the actual study took place in five provinces (see, Table 1). The provinces had been conveniently selected on the basis of easy access to interact with intended participants. Prior arrangements were made with district officials and principals to access district offices and schools for data collection. Subject advisers and service providers were contacted separately to secure appointments for the interviews. Each one of the five provinces was visited by two DME researchers and these were dispersed to various districts to meet prospective participants. The pilot data were finally collected towards the end of the second school term. All trips were sponsored by the University of South Africa (UNISA), and in each instance the data collection activity lasted for almost one week.

4.6 Data collection

Our site visits to districts and schools were to capture assertions participants made about their MCPDP experiences and to gain insights and understanding on the operationalization of MCPDP at various levels. Table 1 reflects on the participation profile of our pilot study.

Table 1: Description of study participants and their designated data collection instruments

Participating group	Type of instrument	Number/ gender of participants		Province ²				
		Males	Females	EC	NW	GP	MP	LP
HoDs for education	Interview schedule	2	2	-	1	2	0	1
District Director	Interview schedule	9	-	5	1	0	1	2
Subject adviser	Interview schedule	9	-	6	3	0	0	0
Principal	Interview schedule	6	5	3	1	1	4	2
Service provider	Interview schedule	1	-	1	0	0	0	0
Teachers	Questionnaire	10	7	8	4	0	5	0

Even though most of the acronyms assigned to provinces in Table 1 are official descriptors, some of the acronyms designated to provinces were coined by the author to subscribe to the layout of this paper. For instance, LP is not an official descriptor for the Limpopo province. Limpopo is one province not having an official acronym in South Africa.

5. THE FINDINGS OF THE PILOT STUDY

The objective of this section is to provide the findings of the baseline data from the pilot project to inform the efficiency of instruments and the methodology of the main study.

5.1 Teachers' questionnaire

The questionnaire data were collected from 17 mathematics teachers across five participating provinces (see, Table 1), and most concerns and item modifications emerged from this data source. As researchers we noted that some of the teachers experienced challenges with the language in the questionnaire, and in some instances researchers had to explain the meaning of certain sentences and phrases. When analysing data from teacher questionnaires we noted that in some of the items, where possible responses had been supplied by researchers, there was a need to insert the phrase "and others". For instance, we had earlier framed item 10 in the manner that is demonstrated in Example 1:

<i>How often are MTPD programmes provided? Please tick (v).</i>	
<i>a. None</i>	<input type="checkbox"/>
<i>b. Once a year</i>	<input type="checkbox"/>
<i>c. Twice a year</i>	<input type="checkbox"/>
<i>d. Three times a year</i>	<input type="checkbox"/>
<i>e. Four times a year</i>	<input type="checkbox"/>
<i>f. More than four times year</i>	<input type="checkbox"/>

Example 1: An example of item 10 from teachers' questionnaire

When completing the questionnaire some teachers indicated that the response options did not reflect on their experiences, and we opted to insert option (e) in Example 1 to cater for these teachers. The new added item in Example 1 would then be: [(e) *Other(s):* _____]. Table 2 illustrates some of the processes that were followed during a data analysis process for a teacher questionnaire.

The process demonstrated in Table 2 applied to other data analyses processes in different participating groups. However, the space in this paper would not permit the inclusion of all related tables.

5.2 Principals' interviews

The interviews were conducted with 11 principals and their subsequent responses suggested that the

². In Table 1, EC=Eastern Province; NW=North Western Province; PG=Gauteng Province; MP=Mpumalanga; and, LP=Limpopo Province. It must be noted that the provinces in Table 1 are five of the nine provinces of South Africa.

interview items were well formulated. Two items were found to be problematic and needing the attention of the researchers (item 2 and item 3). Item 2 had initially been posed as follows: *In what way are the continuous professional development activities carried out in the school?* The post interview responses suggested that the phrase “*in what way*” was almost ambiguous and not prone to elicit the intended data. In some instances, principals requested clarity on the phrase “*in what way*”, suggesting deficiencies in the appropriateness of the item. After our reflection on these observations we opted to recast item 2. The revised item was: *What activities do you have in your school that are in line with continuous development programme?* In item 3 the phrase “*at school*” was removed as it was observed that it almost featured twice in the question (Item 3: *Do you think the implemented continuous development programmes at school improve the teaching in the school?*).

5.3 Subject advisors’, the service providers’ and the HoDs for education’s interviews

When we analysed data collected from the subject advisors’, the service providers’ and HoDs, instruments I noticed that there was a collective agreement that the items in the instruments would not be altered. For the subject advisors we collected data only in Eastern Cape (n=6) and North West provinces (n=3). In other provinces we could not secure appointments with participants. Although we opted not to alter the items in these instruments we however resolved that we would add one item to give ground for participants’ views: *Is there anything more that you would like to say to us regarding MTPDP?*

5.4 District Directors’ interviews

When interacting with the data collected from the District Directors’ interviews we proposed two item revisions, involving item 2 and item 8 of the instrument. Item 2 was initially posed as: *What kind of PDP do you provide for mathematics teachers in the district?* The analysis of data for this item suggested that respondents needed guiding responses to the item. We resolved that the bracket would be inserted at the end of the item with the following possible responses: *content knowledge, instructional skill and strategy, methods, etc.* Item 8 was reviewed and changed to a more direct and simpler version. It appeared that the first version of item 8 was not properly formulated: *What kind of support do you get to facilitate the implementation of MCPD programmes (donors and other kinds of support)?* It appeared that the researchers aimed to probe the respondents on the source of funding for MTPDP activities, however, the item did not make this point explicit. The revised item read: *Who funds the MCPD in your district?*

Table 2: An illustration of a data analyses process for a teacher questionnaire

Instrument	Initial item/ response option(s)	Revised item/ decision on the item	Rationale for revision	Linking pilot objective
Section: A				
	Item: <i>Number of teaching years.</i> Options: <3; 4-5; 6-10; 11-15; 16; 17-20; >20.	Item: Retained. Revised options: 0-3; 4-6; 7-12; >12.	Emerging data suggested common responses for teachers tied within the revised and newly designated bracket options.	Objective 1: Appropriating items to enhance the quality and relevance of data.
	Item: <i>Gender.</i> Options: Male or Female.	Item: Retained. Revised options: Male, Female, Other.	Modern societies reflect a wide spectrum of sexual and gender orientations. We tailored our instrument to accommodate these scenarios.	Objective 3: Gaining experience and insights on realistic operational issues.

Teacher questionnaire	Item: <i>Highest level of mathematics studied.</i> Options: Diploma; 1 st year under graduate; 2 nd year graduate; 3 rd year undergraduate.	Item: Retained. Revised options: 1=Grade 12; 2=Certificate/ Diploma; 3=Bachelor's degree; 4=Honours degree; 5=Masters' degree; 6=PhD/ Doctorate; 7=Other.	Emerging data revealed unanticipated forms of teacher qualifications. For instance, data revealed that there were practicing teachers with Grade 12 certificate. We also found respondents with post-graduate qualifications.	Objective 3: Gaining experience and insights on realistic operational issues.
	Section: B			
	Item: <i>What are the strengths/ weaknesses of the MTPD programme(s)? Please explain.</i>	Modification: Insert a table of two columns for strengths and weakness. Revised item: <i>In the table below list what you consider to be the strengths and weakness of the MTPDP.</i>	Data from pilot process showed that some teachers tended to choose to provide either strength(s) or weakness(es).	Objective 1: Appropriating items to enhance the quality and relevance of data.
Item: <i>Were the activities mentioned in question 7 relevant to your classroom practice? Yes / No.</i>	Revised item: <i>What were the benefits of the activities mentioned in question 7 for your classroom practice?</i>	The "Yes" or "No" option in the first item seemed not to generate quality data. There revised version tends to invite teachers to provide more details.	Objective 1: Appropriating items to enhance the quality and relevance of data.	

Finally, there were revisions and item modifications introduced to most of the data collection instruments. As part of revisions we opted to incorporate the following items into almost all instruments: *Is there anything more that you would like to say to us regarding professional development? From your own perspective what is your take regarding the MTPDP activities?* The rationale was to provide respondents with a final slot to add any information deemed necessary for data collection. The idea to effect this revision was borne out of the observation that some respondents tended to disseminate more information than the one they were asked to respond to, and we found some of the information they provided to benefit our research.

6. DISCUSSION

Through personal field experience the DME researchers gained valuable insights into the mechanisms of the pilot study. I believe the results of MTPDP pilot study confirmed the feasibility of the main study. The following discussion is facilitated in terms of the objectives of the pilot study.

6.1 Testing the appropriateness of all data collection instruments

Table 2 demonstrated how the DME researchers analysed and tailored items in each instrument to improve the quality and relevance of data. The procedures in Table 2 characterized the data analyses process in almost all instruments. In the end this process helped researchers to achieve the objectives of the pilot study, and most significantly, to optimize prospects of collecting quality data in the main study.

6.2 Trialing the validation process of data collection

The pilot study opened opportunities for researchers to compare and validate data from different sources. A larger component of qualitative data emerged from the interviews. Most of the researchers in the DME team were novice researchers and had little prior experience in conducting interviews. In some instances, certain components of qualitative data were not audio-recorded and researchers opted to capture participants' responses using a conventional pen and paper method. While relying on this recording technique, we however ensured that the key components of the conversations were meaningfully captured. We nevertheless acknowledge that certain components of our

interview data were almost watered down. Irrespective of the experience we found this observation to be highly informative in helping DME researchers to value the significance of using audio-recording facilities in the main study to optimize the prospects of preserving a credible validation process.

6.3 Gaining experience and insights into the operational process of the study

After the pilot process I believe the DME researchers, who were largely inexperienced at the start of the pilot study, are now well positioned to implement the research processes in the main study. The review and modification of all data collection instruments is likely to enhance the quality and credibility of a data collection and the subsequent data analyses in the main study.

6.4 Enhancing the methodological make-up of the study

Our collective pilot experience will contribute greatly to the methodological rigour of the main study. A methodologically rigorous study stands a better chance of publication.

7. CONCLUSION

This paper has demonstrated the importance of establishing specific objectives to be achieved in the pilot study. The paper has demonstrated the value of gathering information prior to a larger study to provide a useful pathway to enhance the research design of the latter. I hope the specific lessons that we acquired from the pilot experience will help us to construct effective operational conditions for our main study, and to optimize our quality data collection mechanisms in the main study. Some of the lessons learnt are, (i) a pilot study may provide advance warning about where the main study could fail; (ii) a pilot study provides an operational model for executing research protocols in the main study; (iii) a pilot study may provide useful insights on whether the proposed methods or instruments are inappropriate or too complicated to comprehend; and, a pilot study may help to ascertain whether the researchers are sufficiently skilled in the research procedures. These observations are not unique and have been corroborated in several studies (for examples, see, Dhlamini, 2016; Hazzi & Maldaon, 2015.). The DME researchers successfully conducted the MTPDP pilot study, which helped them to undergo several significant shifts in their research knowledge and understanding. The new paradigm of knowledge will be incorporated into the main study design to enhance its rigor.

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