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Teacher Preparation and Continuing Professional Development in Africa



Learning to teach early
reading and
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Acronyms

APHRC	African Population and Health Research Centre
CEB	Commonwealth Education Fund
CPD	Continuing Professional Development
CRT	Criterion Referenced Test
DFID	Department for International Development
ITE	Initial Teacher Training
KIE	Kenya Institute of Education
MUSTER	Multi-Site Teacher Education Research
NALAP	National Literacy Acceleration Programme
NGO	Non-Governmental Organisation
NQT	Newly Qualified Teacher
PASEC	Programme d'analyse des systèmes éducatifs
PCCK	Pedagogical Content Knowledge
PHARE	Programme Harmonisé d'Appui au Renforcement de l'Education
PTC	Primary Teachers College
SACMEQ	Southern African Consortium for Monitoring Education Quality
SERENA	Stratégies Actives pour la Réussite d'une École Novatrice en Afrique
SARPE	Stratégie Alternative de Recrutement du Personnel Enseignant
TLM	Teaching and Learning Materials
TPA	Teacher Preparation and Continuing Development In Africa
TTC	Teacher Training College
UNESCO	United Nations Educational Scientific & Cultural Organisation
USAID	United States Agency for International Development

CHAPTER 1: Introduction, Context and Methodology

1.1 Research context

The global campaign for *Education for All* by 2015, has seen a great expansion of primary education in African countries. Between 1999 and 2005 the number of children in school rose by 36% and the trend continues (UNESCO 2008). While this rapid increase deserves celebrating, these encouraging numbers hide two main challenges which are closely intertwined. First, such a rise in school attendance requires a large and fast increase in numbers of teachers and in many African countries, the task of training so many teachers quick enough to respond to immediate needs is proving particularly daunting. Second, building schools and filling classrooms will have little social and economic impact unless children learn at least the basic minimum competences of literacy and numeracy. Unfortunately, much evidence suggests that many children who attend school may not learn enough to enable them to benefit from and contribute to their society's future. UNESCO (2008:2) reports a 'relatively low and unequal learning achievement in language and mathematics' in many countries especially in sub-Saharan Africa (SSA). Indeed, what happens in the lower grades is particularly important. Children's early experiences with learning shape their attitudes and commitment to education and those who fail to make sufficient progress at this stage either drop out or become the 'silently excluded' who are not able to access the increasingly demanding work of the later grades (Liddell and Rae 2001; Lewin 2009; UNESCO 2010; Glick and Sahn 2010). This is particularly true in reading and mathematics which underpin understanding across the school curriculum.

In order to face the challenge of the immediate demand for teachers, some countries have introduced fast-track or minimal training as a swifter and cheaper alternative to a traditional college course. Other countries have simply boosted the number of candidates into their existing programmes. It is not clear to what extent these programmes necessarily translate into effective classroom practices. Efforts are also being made to equip teachers with enhanced skills and competencies through continuing professional development. However, while there is evidence that both pre-service and on-the-job training of teachers at primary school are the key ways in which teachers learn to teach (Darling-Hammond, Wise & Klein 1999; Lewin & Stuart 2002), research indicates that induction support for the Newly Qualified Teacher (NQT)¹ can be negligible, with a 'washout' effect occurring as a result (Lewin & Stuart, 2003). Socialization into existing school practices may quickly overwhelm the effects of training, especially in systems where seniority creates status hierarchies that promote conformity to established practices by NQTs (Westbrook et al. 2009).

Teacher education has been identified as both part of the problem and the solution to the challenge of quality. Indeed, research on teacher quality shows that weaknesses in teachers' pedagogical content knowledge (PCK) and classroom practice undermine effective student learning and achievement (Pontefract & Hardman 2005; Akyeampong, Pryor & Ampiah 2006; Moon et al. 2005; Byamugisha & Ssenabulya, 2005 and other SAQMEC country reports). It is widely assumed that initial teacher education (ITE) and continuing professional development (CPD) make a difference to teachers' pedagogic knowledge and skill which in turn is reflected in enhanced student learning outcomes (Dembélé & Lefoka, 2007). However, commitment to improving quality primary education in sub-Saharan Africa has focused primarily on infrastructure (e.g. classrooms, equipment, learning materials) and the supply of adequate numbers of teachers, and less on how teacher education can promote teacher competencies that meet the learning needs of students in real classrooms (Moon 2007; Bernard, Tiyaab, & Vianou, 2004).

The research project *Teacher Preparation and Continuing Professional Development in Africa* (TPA), funded by the William and Flora Hewlett Foundation, was set up to fill the gap in knowledge about how the initial and continuing education of teachers impacts on the practice of teachers through studies in Ghana, Kenya, Mali, Senegal, Tanzania and Uganda. Because of the extreme importance of early reading and mathematics for future progress, it has focused on the preparation that teachers who teach in the lower primary grades receive and what support is available

¹ In the project, we use the term 'trainee' to denote those still undergoing initial training and 'newly qualified teacher' (NQT) for those in the first three years of service. 'Pupils' refer to those whom they are teaching in the primary/elementary schools.

through CPD and other routes to teach these subjects. The research has built up a comprehensive picture of teacher preparation related to reading and mathematics in the early years of primary school. It has sought to identify factors that contribute to successful practice and that lead to increased pupil learning outcomes, as well as specific barriers and constraints that impede teacher practice and pupil progression in basic numeracy and literacy. In particular it has addressed the following research questions:

1. How do pre-service teacher education programs prepare trainee teachers to teach reading and mathematics in the early grades?
 - a. What assumptions about learning to teach reading and mathematics can be deduced from the structure and content of the primary teacher training curriculum, and from school textbooks?
 - b. How does the teacher education curriculum and their implicit and explicit theoretical base relate to the curriculum for early years in language and mathematics in schools?
2. How do trainee teachers develop their understanding of teaching reading and mathematics to early grade students?
 - a. How do these relate to college courses and experience during a structured practicum?
3. How do newly qualified teachers teach reading and mathematics in their first few years of teaching?
 - a. How does this practice relate to what has been taught and learnt in pre-service training?
 - b. What support do they draw on in developing their practice?
 - c. What is the nature of the gap between what the research literature says about teaching reading and basic mathematics in early primary schooling, and what beginning teachers actually do in their classrooms?
4. What are the characteristics of professional development programs with a mathematics and/or reading focus that have been implemented over the past three years?
 - a. Which teachers have they been designed for, and how were these teachers selected?
5. How do the graduates of professional development programs teach reading and mathematics to early grade students?
 - a. What changes in teacher practice can be linked to their participation in professional development programs?
6. Which teaching competencies and skills should be incorporated into the curriculum of primary teacher education programs and which should become the preferred focus of teachers' professional development activities?
7. How cost effective are major pre-service and CPD programs with mathematics and reading focus?
 - a. What is the relationship between the cost per trainee and extent to which teachers develop their understanding and adopt desired practices)?
8. How can professional knowledge and skills in teaching reading and mathematics be effectively transferred and shared within and among primary teacher training programs and beginning teachers?

1.2 Research design

The research was designed to identify the different knowledge, understanding and practices expected of teachers during their preparation and then comparing them with those that they actually exhibit at different points in their training and career. The points of comparison are summarized in Figure 1.1 The first step was to establish what the different ITE programs seek to develop in terms of competences relevant to the teaching of reading and mathematics in the countries studied. This was done through an analysis of documentation including the analysis of programs' aims/objectives and expected standards as well as through interviews with the providers.

The second set of data sought to build up a picture of the knowledge, understanding and practice of actual trainee teachers at the end of their training. Both quantitative and qualitative data were used to develop this. Qualitative data derived from focus groups and interviews following observation of teaching on the ITE program. Direct inference about the training from observation is problematic and possible only through frequent and lengthy observation, a scale outside the means of the project. Researchers therefore used observed sessions of mathematics and reading training as preliminary data for focus group discussions with a sample of trainees in each college, selected as far as

possible to include a range of achievement, a balance of gender and ethnic background, in consultation with their teacher educators. Moderation of the discussion was designed to consider the extent to which what was observed reflected the training as a whole, using the video and shared experience of the session to probe pedagogic content knowledge and understandings of teaching practice. A similar approach was followed in interviews with the trainers whose sessions had been observed.

The quantitative data derived from a questionnaire, developed from one that had been used successfully in other work (Akyeampong 2003). It was administered to a sample of trainees as illustrated in table 1.1. This was based on a common set of items with small amendments to ensure that the form used appropriate terminology, following piloting in each of the six countries. The questionnaire demanded relatively closed responses, and as well as straightforward questions included a series of scenarios that are likely to be encountered in teaching in early grades. Respondents were then required to select responses to the scenarios which describe the most appropriate approach to teaching a particular concept or skill in reading and mathematics. These responses then gave access to trainees' pedagogical content knowledge and likely pedagogical practice in reading and mathematics. Table 1.1 and figures 1.2-1.3 provide details of the quantitative sample.

Figure 1.1: Comparison and tensions

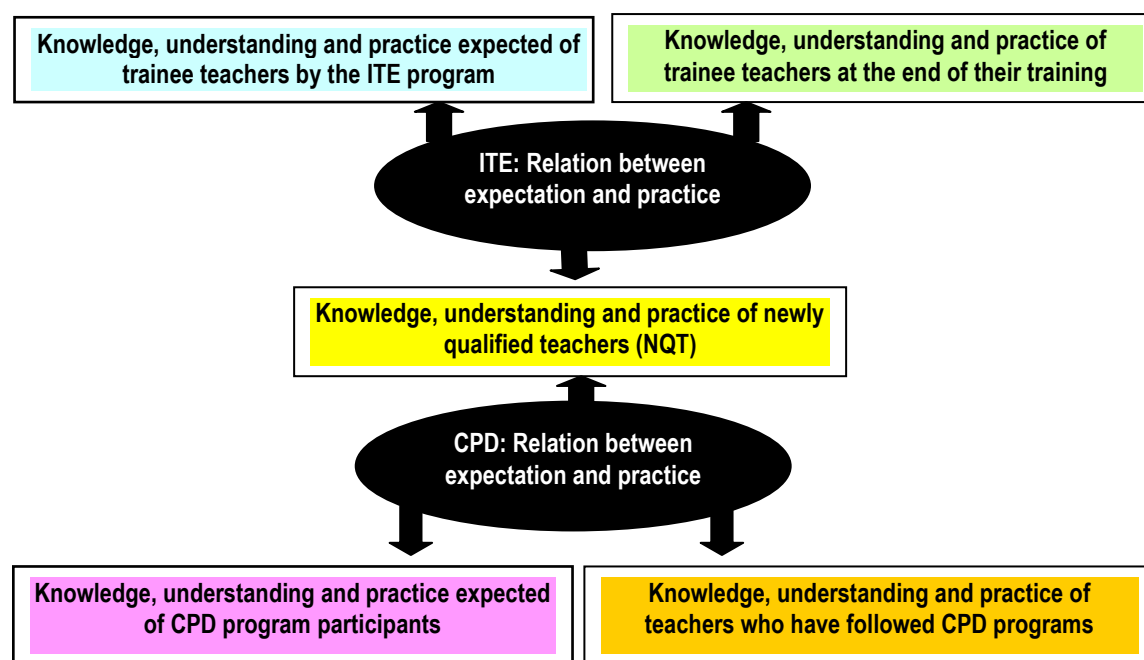


Table 1.1: Number of respondents to the questionnaires by country and category

Country	Ghana	Kenya	Mali	Senegal	Tanzania	Uganda	Total
Teacher	156	157	233	184	254	95	1,079
Trainee	646	1,299	571	835	848	500	4,699
Total	802	1,456	804	1,019	1,102	595	5,778

The task of understanding how ITE is put into operation involved collecting a data set on the knowledge, understanding and practice of newly qualified teachers (NQT). A sample of schools was selected where teachers in the first three years of their career were working. Videoed observations of lessons in reading and mathematics by the NQTs were followed by forensic interviews asking questions around details of practice, sequencing of tasks, and use of resources, progression within the lesson and onwards towards the next, and use of language of instruction as against mother tongue or local lingua franca. Again this form of interview was designed –to give a greater

understanding of what teachers actually know and can do than direct inference from observation. Interviews were informed by evidence of the educational attainment of pupils from exercise books, records of assessment and where possible brief interviews with pupils. Head teachers in all sample schools were also interviewed on the issue of NQT support and management especially as related to teaching reading and mathematics. In addition a slightly adapted version of the questionnaire used for trainees was given to NQTs.

Figure 1.2

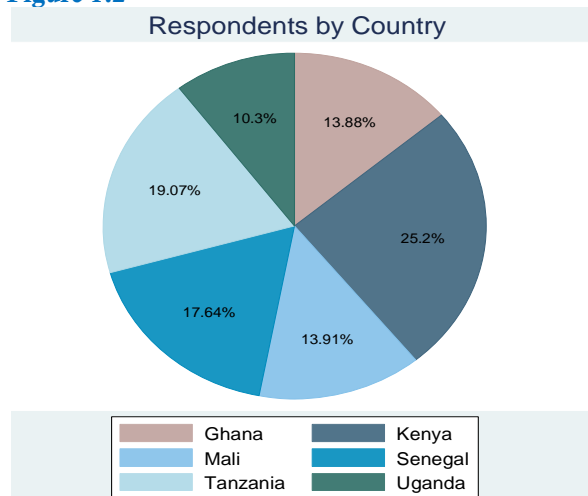
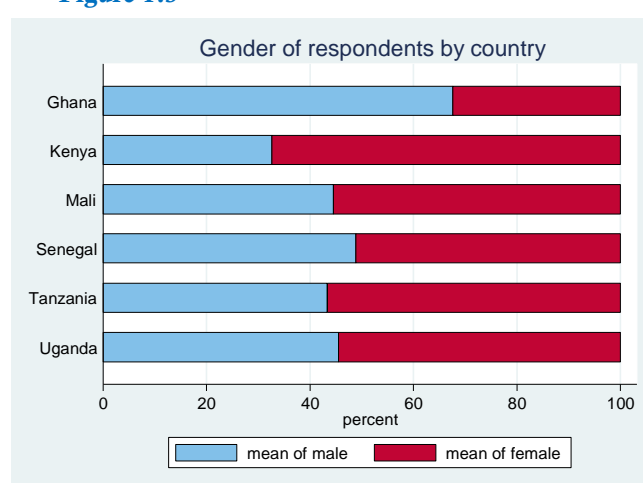


Figure 1.3



A similar approach was also used to investigate continuing professional development programs (CPD). An initial survey of what is available in each country was conducted by the national research teams. This gave an account of what the programs were intending to achieve. As a point of comparison the project collected data on the knowledge, understandings and practice of teachers who had recently participated in CPD programme(s). This followed exactly the same procedure of observation, interview and questionnaire as for the NQTs.

Analysis of the different data sets represented by the coloured rectangles in figure 1.1 enabled the project to address the research questions. It did this by building up a detailed description of the knowledge, understandings and practices of teachers during the different phases of preparation and using these as a basis for comparing what is occurring in the field with what is intended. For the qualitative data, interviews and focus groups were transcribed and imported into the Nvivo 8 qualitative data analysis software along with other appropriate texts such as summaries of observations. Data were coded and sorted by the national teams supported by Sussex researchers. Systems of hierarchical categories were developed in each country through a collaborative and iterative process. Knowledge, understanding and practice were central to all of them allowing cross-country comparison. This enabled patterns to be identified and queries to be run both at country and cross country levels.

Quantitative data were analyzed using STATA software. This enabled the project to work with a large data set and to provide appropriate tables and graphs. It was then possible to make relevant interpretations from descriptive statistical methods with some use of inferential statistics such as the calculation of Pearson's χ^2 to test for independence and Cramer's V to measure effect size².

² These are reported in the individual country reports

1.3 Background of the respondents in the 6 countries

In order to fully appreciate the nuances in the research findings, it is important to understand how the background of the respondents varies between the six countries. For the trainees, we found cross-country differences on three aspects: age, qualification at the beginning of the training and prior experience of lower primary teaching. These are illustrated in the tables 1.2, 1.3 and 1.4. We found for instance that teacher trainees are much younger in Uganda where nearly 60% of the trainees are 20 years old or younger than in the other countries and that the age of trainees is much more spread in Senegal and Kenya (see figure 1.4). While trainees' age in itself is not particularly informative, great variations of students within one cohort can have pedagogical implications in the sense that their experiences will be more varied and that they may have different expectations from the education they receive. Mature students also require a different type of support compared to their younger counterparts. Moreover, taken in combination with trainees' qualification level, age can provide useful information for planners and curriculum developers.

Figure 1.4

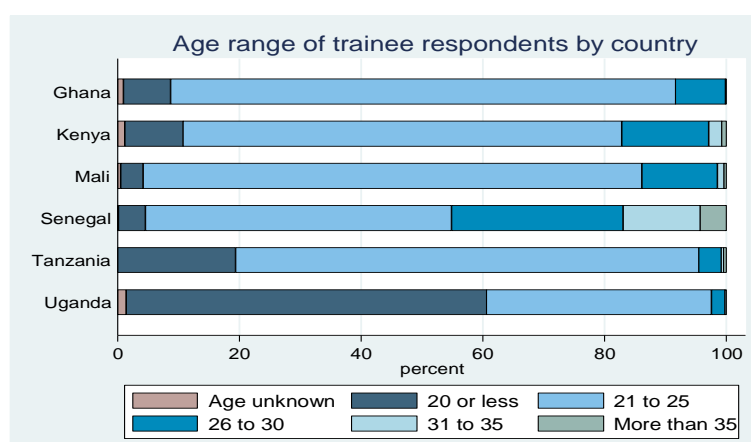


Table 1.2: Age of trainees by country

Country	Obs	Mean	SD	Min	Max	Age range (% of trainees by country)					
						Age unknown	20 or less	21 to 25	26 to 30	31 to 35	+ 35
Ghana	640	22.864	1.9965	19	40	0.93	7.74	82.97	8.20	0.00	0.15
Kenya	1284	23.457	3.0395	15	40	1.15	9.55	72.13	14.32	2.08	0.77
Mali	568	23.834	2.3632	19	47	0.53	3.68	81.96	12.43	1.05	0.35
Senegal	834	26.141	4.4218	18	39	0.12	4.43	50.30	28.26	12.57	4.31
Tanzania	848	22.036	2.0838	18	37	0.00	19.34	76.18	3.66	0.35	0.47
Uganda	493	20.565	1.9407	17	31	1.40	59.20	37.00	2.20	0.20	0.00
All	4667	23.338	3.321	15	47	0.68	14.73	67.93	12.51	3.02	1.13

Table 1.3 below presents the highest qualification of the trainees at the beginning of their initial teacher training. Again, it highlights the diversity of background from the trainees of the two francophone countries. Incidentally, Mali and Senegal are the two countries where there is a 'fast track' option for becoming a teacher. One can therefore appreciate the challenges of providing an adequate balance of content knowledge and pedagogical content knowledge when the target audience starts at very different levels and when time of instruction can be as limited as 3 months. Table 1.3 also reveals that teachers from the three East African countries tend to enter the teacher training colleges with basic school completion as opposed to Ghana where all the trainees have completed senior secondary school and more than 23 percent have had some form of experience of lower primary teaching.

Table 1.3: Highest qualification of the trainees at the beginning of the training

Highest Qualification	% of trainee respondents by country						
	Ghana	Kenya	Mali	Senegal	Tanzania	Uganda	Total
Basic School Completion	0.00	99.29	62.00	56.69	74.76	93.70	68.61
Post Basic Vocational qualification	0.00	0.63	22.59	1.91	0.00	0.00	3.30
Senior Secondary School	100.00	0.00	15.06	33.76	25.24	6.30	26.73
Higher Education	0.00	0.08	0.35	7.64	0.00	0.00	1.37
Total (Frequency)	635	1,275	571	785	848	492	4,606

In order to understand the cross-country differences in terms of the knowledge, understanding and practices of the NQT, it is important to appreciate the variations in terms of the preparation that NQTs have when they start teaching. Two components need considering. First, the extent of schooling they had before doing their teacher training course and second, the duration of their initial teacher education.

Table 1.4: Experience of teaching in a lower primary class (up to grade 3) before starting teacher training

		Country	Ghana	Kenya	Mali	Senegal	Tanzania	Uganda	Total
Teachers	Frequency		28	35	39	19	24	30	175
	Percent		18,06	22,88	16,81	10,38	9,45	32,26	16,36
Trainees	Frequency		151	249	0	45	89	39	573
	Percent		23,52	19,61	0	5,39	10,5	7,99	12,31

Table 1.4 is an attempt at breaking down the different types of NQT respondents according to their schooling. Again, the diversity within country is striking in Mali, as opposed to Kenya and Ghana, where all respondents had the same level of schooling, which is 12 years of education followed by 2 and 3 years of teacher training respectively. These differences should be kept in mind when interpreting the research findings but since they can have an impact on continuing professional development initiatives they should also be acknowledged when planning interventions aimed at supporting teachers.

Table 1.4: Schooling level of the NQT respondents by country (% of NQT participants)

Schooling (years)	(+) ITE (years)	Ghana	Kenya	Mali	Senegal	Tanzania	Uganda
9	0.25			19,55			
10	up to 0.75				60.80		
11	0.25			51,88			
11	2			66,17*			79.66
11	2+upgrade						20.34
12	0.25			16,44			
12	2		100			99.46	
12	3	100					
13 or more	0.25			12,03			
13 or more	up to 0.75				39.20		
14	2					0.53	

* Some Malian students from the IFM (teacher training institute) did the 9 + 4 programme where the first 2 years is equivalent to senior secondary.

Chapter 2: Initial teacher education structures and curricula.

2.1 Initial teacher education in the six countries

This chapter gives an exposition of the ITE programs in the six countries of our study, setting it against the backdrop of what initial teacher education aims to do. It provides an overview of the range of structures studied by the project, bringing out points of contrast and of similarity. It then goes on to look at the published or desired curriculum for teacher education in the two focus subjects of reading and mathematics and to appraise these with respect to the way that they relate to the primary school curricula in operation in each country. In particular, the chapter considers whether, even under ideal conditions teacher education systems are set up to prepare trainees to put into practice what educational planners are aiming for.

2.1.1 Purpose of ITE

There is general agreement that the purpose of initial training is to equip those entering the teaching force with the knowledge and skills needed to be able to perform the duties of a successful teacher. However underlying this simple statement there are several complexities which produce tensions in all the countries studied. These largely concern the issue of the nature of the knowledge that teachers need.

One key issue is that of subject content knowledge: whether the schooling of those entering training has given them sufficient understanding of the subjects they will teach at primary school level or whether training needs to include a continuation of their general education up to a higher level. This issue was seen to be relevant both in contexts where trainees had only completed basic schooling such as Kenya and Uganda, and in those such as in Ghana where they had all achieved a senior high school qualification. Within this is a question of what kind of further knowledge is necessary; for example whether understanding calculus helps teachers to be able to teach simple mathematics or studying and critiquing adult literature assists their teaching of early reading. Some tutors interviewed also expressed a concern over whether trainees' knowledge at the level of the primary curriculum was secure. In some cases this is a question of whether they can do the exercises set for primary pupils, but more often it is about the depth of conceptual understanding of the work at the children's level. Also, although the study focused on those training to teach the early years of primary schooling, most of the courses studied aimed to train teachers for all primary grades, and in the case of Ghana and some teachers in Tanzania, for junior secondary schooling also. A further complication here is that, as teaching qualifications may need to show equivalence to those elsewhere in the educational system this may lead colleges to emphasize subject content knowledge to ensure some comparability and engagement at tertiary level.

Pedagogical knowledge, knowledge of how to teach, is obviously the stuff of courses on teaching, but there is a tension here also. Some pedagogical knowledge can be generalized regardless of the content, but research on teaching, particularly since Shulman's (1987) influential work has underlined the importance of pedagogical content knowledge (PCK), that is, knowledge of how to represent content to others. Ball (2000) describes PCK as "a special amalgam of knowledge that links content and pedagogy [including] knowledge of what is typically difficult for students, of representations that are most useful for teaching a specific idea or procedure, and of ways to develop a particular idea ..." (p 245). PCK embodies the ability to *evaluate students thinking* in order to plan appropriate learning opportunities, as well as *modify, combine*, and use instructional materials to develop conceptual understanding (Darling-Hammond et al., 1999 emphasis added). Ball argues that "identifying core activities of teaching such as figuring out what students know, choosing and managing representations of ideas, deciding alternative courses of action, and analysing subject matter knowledge are essential elements of content knowledge for teaching mathematics" (p 244). Often, linking subject content and pedagogy in ways that are flexible and responsive to the context of practice is not given sufficient attention by teacher education curriculum developers. The challenge that ITE faces "is how to create opportunities for learning subject matter that would enable teachers not only to know but to learn to use what they know in the varied contexts of practice" (Ball 2000, p 246).

Sometimes attempts to develop PCK in prospective teachers lack this conceptualisation – Ghana is a case in point where emphasis is placed on acquiring procedural methods as scaffolds for learning to teach (Akyeampong 2003). In effect, what prospective teachers should know and be able to do is reduced simply to a set of knowledge ideas, teaching sequences and prescriptive instructional aids. Research on teaching, particularly in the US has demonstrated the importance of also having knowledge about learners and learning, the curriculum and teaching, and using multiple skills rather than relying on set of uniform teaching behaviours for all teaching circumstances (Darling-Hammond et al., 1999). In addition, effective teachers possess a strong sense of the context-dependent nature of teaching knowledge so that what they teach reflects differences in how students understand the subject (Darling-Hammond et al., 1999).

Despite the prime importance of PCK it is not the only kind needed by teachers. Initial training may also require knowledge of the official curriculum that has been adopted for primary schools and in the countries studied new curricula were being introduced which were changing not just the way that content was structured but also pedagogical approaches.

A further area of knowledge that initial training may address is that of knowledge of the learners – questions of their development as children, their sociocultural context and their diversity of language, ability and disability. Finally there are areas of professional knowledge such as the law relating to teachers and schooling and the responsibilities of a government employee.

Knowledge for Teaching

- Subject matter content knowledge
- General pedagogical knowledge
- Pedagogical content knowledge
- Curricular knowledge
- Knowledge of learners and their contexts
- Other professional knowledge

However teaching is not just about propositional knowledge – knowing that – it is also, indeed mainly, about knowing how. All of the initial training systems studied recognize this, in part by incorporating a practicum which is given a greater or lesser emphasis. The crucial question here, which perhaps gives rise to the greatest tension of all in the research in the six countries, is whether college courses, usually designated the theoretical element of training, and teaching practice, the practical element, can be undertaken and thought about separately. The way that teacher training seemed to be conceived of by tutors and trainees alike was

that the purpose of college-based initial training was to gain the knowledge which could then be applied when trainees go into schools. Our analysis suggests that knowing how to teach involves a much more complex articulation of different types of knowledge with practice in schools than this dichotomised notion of learning to teach.

One further but very relevant issue is the extent to which it can be assumed that sufficient knowledge has been acquired through trainees' previous education and life experiences. This may also be a question not so much about knowing as about unknowing. Wherever they come from, trainees enter training with detailed knowledge of what teaching and learning is about, gathered through their own experiences within the educational system, what Lortie (1975:61) described so tellingly as their 'apprenticeship of observation'. Their presence as trainee teachers implies that for them the experience has been at least in part successful, since they have been able to make progress. What they may be less conscious of is how it has worked for the majority of their peers who have dropped out or failed on the way. Apart from this, the curriculum that they engaged with will almost certainly be different from that which is currently in operation or planned. Whilst some of what they know about teaching and learning from this experience may be useful, other parts may be unhelpful to them in developing the competences they need to become teachers now and in the future. This suggests that teacher education programs need to engage with this knowledge that trainees come with, to exploit it where it is useful and appropriate and to challenge it where it is not. As Dembélé and Miaro-II (2003) point out, and as is confirmed by this research, teacher education has been notably unsuccessful in doing this.

2.1.2 Structure and Duration

The structure of the initial teacher training courses studied is summarized below. Table 2.1 relates to full, traditional training courses which aim to produce qualified teachers with a diploma or certificate. Senegal abandoned this kind of training in the early 90s and moved over to an accelerated training of contractual or volunteer teachers. This and the similar system in Mali which runs alongside the full residential training course are shown in Table 2.2.

Table 2.1 Structure of training –residential college courses

	Kenya	Tanzania	Uganda	Ghana	Mali College
Grade Level	1-8	1-7 or 1-11	1-7	1-9	1-6
College course	2 years	2 years	2 years	2 years	1 year or 3 years
Subjects	9 subjects content Professional studies	10 subjects content 10 subjects methods courses Professional studies	5 subjects (content and methods) integrated Professional studies	8 subjects content 8 subjects methods (2 specialist) Professional studies	11 subjects content 8 subjects methods (one term only)
Medium of instruction	English	Kiswahili	English	English	French
Assessment	National examination in all subjects Pass teaching practice	National Examination Pass teaching practice	National Examination in all subjects Pass teaching practice	Continuous assessment (40%) and national examination in each subject Pass of practicum	Examination in all subjects
Practicum	3 weeks grade 1-3 3 weeks grade 4-5 3 weeks grade 6-8	2 x block 1-2 months Single lesson practices	3 x 3-4 weeks	1 year following college course	3 months at the end of college course then 1 whole year
Qualification	Certificate	Certificate/diploma	Certificate	Diploma	Diploma

Table 2.2 Structure of training – accelerated courses

	Mali Alternative	Senegal
Grade Level	1-6	1-6
College course	45 days	6 months (incl. practicum)
Subjects	8 subjects methods Professional studies	5 subject methods 6 professional studies subjects
Medium of instruction	French	French
Assessment		Continuous assessment and national examination.
Practicum	45 days	3 weeks grade 1-2 3 weeks grade 3-4 3 weeks grade 5-6
Qualification	None	None

In all the East African countries, and in Ghana, the College course lasts two years. In Mali the duration depends on the previous schooling of the trainees. Those with a baccalaureate (senior secondary leaving certificate) go directly to one year of teacher training. Those who enter direct from basic education spend two years at the College but this is to enhance subject content knowledge. Although the medium of instruction in the schools may be an African language apart from Tanzania, where Kiswahili is used, all teacher training is conducted in the official language, either English or French. All courses incorporate a practicum but the degree to which this is considered part of or separate from the College course varies. At one extreme, colleges in Tanzania have demonstration primary schools in which trainees carry out single or double lesson practice although these are infrequent and erratic. At the other end is Mali, where the year's practicum is organized and supervised independently of the college with trainees only returning to complete their final examination. Apart from Mali and Senegal, the trainees are visited during their practicum by college staff, who play a part in assessing their practical teaching. In all contexts, the practicum was assessed though in Senegal this was done indirectly through the written work done during the practicum. .

The curriculum of the training colleges includes teaching of both subject content knowledge and of the methods of teaching. These may be the responsibility of the same tutor and take place concurrently or else be assigned to separate terms or semesters. In Mali trainees study a different set of content subjects from those studied at methods level and even these relate to the older 'classic' teaching programme still in use in many primary schools but not to the new competence-based curriculum which is organized around domains rather than traditional subjects. Indeed in all of the countries with the possible exception of Ghana, thematic or competence based curricula had been recently introduced and were in the process of being implemented. The balance between time spent on content and on methods varied – in East Africa it was roughly even, whereas colleges in Mali devoted only one term to methods teaching, which amounted to less than the time spent during the accelerated training. In Ghana too, methods teaching was confined to one of the four semesters.

The other element that made up the training in the colleges is generally termed professional studies and relates to those issues referred to above as other professional knowledge, although it may also include elements of general pedagogy. In Tanzania for example it was defined as 'understanding of how children learn and how cognitive, affective, psychomotor and social development take place, knowledge and skills in classroom management and parental care, craft knowledge of effective techniques to promote learning, acquisition of professional identities as a teacher, awareness of educational history, psychology, sociology, legislation and responsibilities.' (MOE,2010). Early childhood education is a compulsory element of the training in both Tanzania and Uganda.

Apart from the short course in Mali all of the training was assessed by examinations which included subject knowledge as well as pedagogic knowledge. In most places the nature of these examinations, requiring the reproduction of propositional knowledge bore heavily on the curriculum in the colleges, since failure in one subject could lead to failure overall. However in Senegal, it appeared that failure was a very rare occurrence.

2.1.3 Profile of ITE participants.

Studies of primary teacher education have noted that tutors do not generally have much professional experience of the primary classroom (Lewin & Stuart 2002). This was generally true of the tutors encountered in this study. Whilst it is possible in each country for former primary school teachers to become College lecturers it was not the norm. However increasingly they are expected to be university graduates. For example in Uganda the current minimum qualification is a bachelor of education and those in post without a degree are encouraged to upgrade. Some tutors for example in Kenya and Mali came straight from university into teaching at college level. However most frequently, the experience of teaching of tutors who taught prospective primary teachers was at secondary school level. Their education was in the content knowledge of the subject they were teaching rather than in primary pedagogy, though a notable exception was Mali where all methods teaching is done by tutors with a background in educational psychology and philosophy. Tutors in the two shorter courses had similar qualifications but were seconded either full or part time from the advisory and inspection service.

2.2 Relation between ITE and school curriculum

2.2.1 General issues of alignment of ITE with school curriculum

The international policy context of basic education in Africa has been very favourable to large-scale curriculum reform. This is driven by several factors. First, there is the perception that the huge increase in access to primary schooling achieved and of the push for education for all, has not been accompanied by an equivalent improvement in the quality of performance of pupils at this level. Indeed, the discourse in most countries is of falling levels of achievement. On the whole, the conclusion that pupils' achievement lags behind enrolment has been supported by large-scale international research such as that carried out by PASEC and SACMEQ and also by national studies such as the Criterion Based Test (CRT 2000) in Ghana and the more recent Uwezo (2010) in Kenya. Such a situation leads to the conclusion that efforts to put more children in schools are being wasted.

Second, although poor performance is partly ascribed to the difficult conditions and lack of resources suffered in most African classrooms, the blame is widely attributed to old-fashioned curricula and ineffective pedagogy. Qualitative research and descriptive research studies in classrooms, as summed up for example by Dembélé & Miaro-II (2003:7), confirm that 'rigid, chalk-and-talk, teacher-centred/dominated, lecture-driven pedagogy ...[which] places students in a passive role and limits their activity in class to memorizing facts and reciting them back to the teacher ... are reported to be the norm in the vast majority of classrooms'. African Governments have therefore looked for ways of changing classroom pedagogy on a large-scale and national curriculum reform offers itself as a solution to this problem. Indeed, the move towards more active, student centred pedagogy is not new and in many countries, where funds are available, often as a result of inputs from development partners, successive changes may have been instituted, sometimes replacing and sometimes overtaking earlier reforms; for example in Mali, the introduction of Convergent Pedagogy (Pédagogie Convergente) from 1987 petered out and has been overtaken by the current competence based Curriculum.

A third impetus to school curriculum reform has been the influence of the research consensus that children learn best when doing so in a language that they already understand. In Mali and Uganda instruction in local languages has been a central part of the new curriculum.

The six countries studied were all engaged in wholesale and/or piecemeal reform of school curricula. The approach of many of the new curricula is generally similar and is termed competence or competency-based in Tanzania, Mali and Senegal and thematic in Uganda. In Ghana, the last main curriculum reforms happened in 2004 to 2005 and built upon more far-reaching reforms operationalized since the restructuring of the education system after 1987. However more recently the Ministry has attempted to impose a superstructure of 'standards' to be reached at each grade level. In competence-based, thematic or standards-based curricula, although content may be specified, the focus is on the achievement of pupils' learning and their ability to apply their knowledge and skills in specific relevant contexts. The process is spelled out most explicitly in the Senegalese curriculum: it asks teachers to create a learning situation where pupils work to solve problems through activities which require the specific knowledge that teachers are due to introduce, as they guide the children them. At the end of a sequence pupils are given a different learning situation requiring the integration of knowledge thus allowing the assessment of the competences involved.

The curriculum situation in Kenya is more complex: curriculum development in the hands of the Kenya Institute of Education is seen as a cyclical process (KIE, 2006); subjects are developed separately and new elements, such as the introduction of Life skills as a subject in 2009, may be grafted onto the basic 2002 curriculum.

Whether explicitly competence based or not, the conceptual basis of all of the curriculum reforms is constructivist and learner-centered. However, as Schwille and Dembélé (2007) point out, in no country has this approach to teaching and learning been successfully implemented on a widespread national scale, because teachers in schools are unable or unwilling to do so. While there may be many reasons for this, one issue identified by the TPA research was that governments' enthusiasm for reform of the school curriculum does not extend to the teacher education curriculum.

Except in Tanzania, the responsibility for the ITE curriculum does not lie with the same institutions as those of basic education and as a result the colleges are seen as part of a separate system. In none of the countries studied did the introduction of the new curricula include concomitant change in the colleges. This meant that even if it fulfilled its aims, it was preparing trainees for a situation that the schools were seeking to move away from. The situation is exacerbated by the fact that although the teacher training curriculum may seek to initiate trainees in active learning methods, the approach most often observed in our research was the chalk and talk of lectures. Similarly, the main means of assessment for teacher certificates and diplomas was examinations, which did not align well with the constructivist approaches advocated by the new curricula, and also in some cases, particularly Ghana, served to focus trainees' attention on the reproduction of propositional content knowledge rather than engagement with the other forms of knowledge outlined above. Although all the countries had some assessment of the practicum, and thus potentially of the way that trainees engaged with the school curriculum, the examinations appeared most important.

Another factor contributing to the misalignment of school and college curricula is that neither college tutors nor trainees are likely have access to the materials, such as teacher guides and textbooks used in schools. Access to the primary curriculum documents and guides was also not always guaranteed.

Further tension is caused by the fact that ITE has failed to catch up with schools use of national languages. In Mali where the new school curriculum is carried out in local languages, the ITE curriculum is delivered exclusively in the official language. In Uganda trainees are taught to teach in local languages but were much more confident in teaching in English. Tanzania was the only country studied where English or French was not the medium of instruction for teacher education, using Kiswahili the *lingua franca* which is also the medium of instruction in primary schools.

2.2.2 ITE curriculum and reading

There is a particular issue about the amount of time accorded to reading in the ITE. In all the college-based courses a larger proportion of time was allocated to subject knowledge in language than to learning how to teach it. In Ghana for example, only one out of four semesters was concerned with methods courses and in Mali one term out of the training. However whilst mathematics is seen as a separate subject, reading is considered only part of the language curriculum and therefore has to take its place alongside the other topics. Indeed in Senegal and Tanzania it did not even merit a topic on its own (see Table 3.4). This means that very little time anywhere was devoted to learning to read despite its acknowledged importance to learning globally in primary education (Cunningham & Stanovich, 2001; Pretorius and Currin, 2010). Within school curricula reading is also not seen as a separate subject. However, the amount of time accorded to it is generally greater proportionally. Indeed, in the different countries the complexity and detail of approaches to teaching reading in school curricula is much greater. This suggests that even on paper teachers are being certified who are not had given sufficient grounding in teaching reading.

2. 4 Reading topics and language in the ITE curriculum

	Number of language topics	Number of reading topics
Kenya	7	1
Senegal	6	0.5
Mali	8	1
Tanzania	5	0.5 + 0.5 =1
Uganda	16	3
Ghana	14	3

In Mali the reading curriculum for ITE is minimal. In the colleges only 10 weeks out of the whole training are dedicated to teaching methods and reading has to find its place amongst other aspects of the French which is allocated two hours per week. In the alternative program, there is slightly more time allocated for French but this works out at less than three days devoted to reading. Although the curriculum suggests a whole range of active

learning approaches, in practice what took place in both settings was simulation of primary reading lessons or parts of them and the preparation of lesson plans. In the limited time that was available what was being taught and what trainees appears to learn was a series of steps for 'the global method' which would be applicable to all reading lessons no matter at what level. This is termed the 'global method' although in practice it begins with a global approach at sentence or text level before moving to both analytic and synthetic phonic exercises. In practice it is these which received most of the attention of the tutors and trainees. In the two main school curricula in force in Mali the approach is similar in principle though the competence framework produced by USAID is called the balanced approach and is elaborated in more detail. However the most striking divergence is that in the new curriculum children learn to read initially in national languages, whereas methods course in initial training in concerned only with on reading in French.

Although teaching of methods is the main element of the accelerated course in Senegal, learning to teach reading is again just one part of French, which limits the amount of time available. A similar sequence, here of eight stages, is proposed for teaching reading, incorporating both text/sentence level and word level work. As formulated by the tutors it makes more explicit the need for comprehension. Once again though there was little differentiation of pupil level. One of the key competences for teacher education in Senegal is the management of a bilingual class, including teaching reading in national languages. In practice though this appeared to receive very little attention and trainees did not feel at all confident in to do this. Here at least there is some correspondence with the school curriculum, which also assumes that reading is taught in French. In other aspects though, the contrast between what may be addressed during training and the level of detail and complexity in the new curriculum in schools is stark. The teachers' guide gives a detailed introduction to the competence-based approach generally and specifies in detail the content to be covered. The examples of how to teach reading are much more varied than the eight stage method taught in the colleges and stress an integrated approach to learning where comprehension is emphasized.

The primary curriculum in Ghana makes three assumptions about teachers: first, that they possess pedagogical knowledge and skills about visual and auditory discrimination and comprehension skills to be used in pre-reading activities; second, that they are skilled in using and combining both phonics and 'look-and-say' methods; and third that they are able to design and use appropriate teaching and learning materials (TLMs) which actively engage all children, whilst paying attention to those with reading difficulties. The college courses appear to address these expectations as all of these form part of the ITE curriculum. However, the problem is once again that although colleges in Ghana allocate 30 hours of learning how to teach reading, which compared to elsewhere is a relatively long time; this does not really allow the depth of engagement that would be necessary, especially since they have to cover reading up to junior high school level.

In Kenya, reading is one of seven topics vying for 70 hours of time allocated for language methods and is differentiated according to whether it is for upper or lower primary. The teaching methods for reading in the lower primary identify subtopics of look and say, phonics, pre-reading skills, reading readiness, informal activities for introducing reading, word attack skills, the sequence of activities for reading lessons, using supplementary materials and individual reading progress. However the ITE curriculum puts more emphasis on acquiring knowledge about reading rather than on its pedagogy. For example, on the Look and Say method it is stated that trainees will acquire knowledge of (i) the purpose of look and say, (ii) the value and limitations of the method, and (iii) look and say activities. As can be seen from the subtopics, the ITE curriculum emphasizes decoding skills. By contrast the school curriculum is organized around content themes such as 'greetings and requests' and 'home and classroom', so that right from the start reading for meaning is brought to the fore. Indeed the first competence specified in the curriculum is 'reading words/sentences/short paragraphs' and pupils are expected to read fairly long comprehension passages in the first two grades. It calls for a much more varied approach to teaching reading than the narrow one provided by ITE curriculum.

In Tanzanian colleges reading is taught as part of Kiswahili through five areas of basic language skills, composition, oral literature, comprehension and structure of language, Reading is not accorded a detailed theoretical knowledge base, but there is specific guidance for tutors about teaching at different levels with detailed examples of how to

teach children to build words from letters and syllables but no mention of how to teach comprehension or bilingualism. Pre-reading skills are taught as part of Early Childhood Education. The competency-based approach of the school curriculum is not really recognized at college level. In schools reading is introduced relatively late in Grade 1 as the fifth topic, taught concurrently with writing and starting with vowels or vowel sounds, later attaching vowels to different consonants to form syllables; to simple words and finally short sentences. Only much later are children introduced to short meaningful texts and reading for comprehension. Stories are then used to teach aspects of the language such as structure, vocabulary, pronunciation and comprehension. While participatory methods are encouraged, only question and answer are given as comprehension strategies, a gap not filled by the ITE reading curriculum which is not underpinned by a theoretical model of early reading development that can explain, for example, how fluency of pronunciation leads to comprehension.

In Uganda, three out of sixteen units focus on reading with one dedicated to teaching beginners, teaching pre-reading readiness and listing the major approaches to include syllabic, phonic, whole word, Look and Say, whole sentence and eclectic. Comprehension is discussed in terms of types of reading, choice of reading materials and development of the learner's independent reading, but fluency and how to teach readers to make sense of whole texts longer than a short sentence are seen as only for upper primary. The ITE Curriculum in Uganda looks thin in comparison with the new primary topic-based Thematic Curriculum, printed in 11 local languages, and taught through an integration of skills using participatory methods and grounded in the daily life of village or town. A combination of word level approaches are encouraged. The ITE lags behind the more learner-focused primary curriculum that encompasses decoding and comprehension of texts.

3.2.3 ITE curriculum and maths

Mathematics, as a subject in its own right, is accorded more time than reading in the ITE curriculum in all the countries studied. However the balance between mathematical content knowledge and the knowledge and skills of how to teach the subject remains an issue. In particular, work on mathematical knowledge is rarely about deepening conceptual understanding of the topics which are taught at primary level, being rather concerned with taking trainees further into more advanced mathematics or reinforcing and repeating the senior secondary curriculum. This immediately raises questions about the alignment of ITE with the school curriculum and whether training time is being deployed most advantageously.

In Senegal as with reading, the guide to teacher training which constitutes the official curriculum is very short on detail. As a result, the programme of study is left very much up to the discretion and capabilities of individual tutors. What is focused on is the preparation of lesson plans and of instructional sequences based on teaching objectives. The vagueness of the ITE curriculum is in great contrast to that of the primary school which is detailed with respect to both content and method. It is divided into geometrical activities, numerical activities, measurement and problem-solving. In keeping with the competence-based approach, it aims to locate all activities in a meaningful context and to go through phases of introducing, integrating and assessing particular competencies. Content is specified and allocated a specific amount of time along with examples of specific activities and problems involving the introduction, application and assessment of each competence.

In Kenya the ITE curriculum is organised around topics not distinguishing between upper and lower primary, whereas the school curriculum is organised by grade with a separate section for each topic at each level. The analysis of the ITE and the primary mathematics syllabuses reveals that there is a gap between the two. While the ITE syllabus focuses more on developing a theoretical knowledge of practical approaches to teaching mathematics and of making and using teaching / learning resources, the primary mathematics has a high expectation that mathematical concepts and skills will be developed practically using teacher made and locally available teaching and learning materials.

In the ITE curriculum in Ghana there is an emphasis on theories of how children learn mathematics and drawing on ideas from theorists such as Piaget, Bruner, Dienes and Skemp and applying them to teaching primary mathematics. Teacher-directed and child-centred approaches to teaching and learning mathematics are equally valued. However

the notion of teachers' knowledge as situated and emerging from understanding how children engage with mathematics and the challenges they face in their understanding is not evident. The objectives of the methods component of the curriculum capture a broad range of skills and abilities but are framed as a mixture between behaviours that would enable trainees to pass a written examination and competences that might be associated with teaching mathematics: for example, 'identify factors that contribute to the inclusion and exclusion of topics for the primary mathematics' and 'explain how children acquire the concept of number and design appropriate activities to enable children perform numerical operations'. Trainees are also required to develop skills in lesson preparation using a fairly structured and prescriptive approach starting from an introduction to main lesson development before the conclusion of the lesson. The primary school mathematics curriculum for the early grades places much emphasis on developing children's numeracy skills as the foundation for further learning in mathematics. Curriculum objectives for the first three years of primary school are the same for upper primary. Topics for teaching are sequenced and sub-divided under units, with each unit structured according to a teaching sequence. The curriculum also acknowledges teachers should provide differentiated instruction and support in the early years' in which a child is learning basic mathematics as progress will be varied. The volume of topics to be covered is very large as many as 15 topics in grade one and the pace of learning expected is rapid with calculation introduced early. By the end of grade one, children are expected to be able to add and subtract numbers up to 99. For the TTCs it raises the issue of program time to systematically study these topics as part of the requirement for learning to teach primary mathematics.

In Mali there is little detail in the ITE syllabus for mathematics and therefore guidance to tutors on how to use the 20 hours allocated to it in the colleges and 44 hours in the accelerated programme. Training focuses on covering different topics in mathematics mainly involving simulation of primary mathematics whereby trainees are required to produce lesson plans. In the accelerated programme, lesson plans are not required but the methods course is also seen as acting as a form of revision of mathematical knowledge for trainees. Whilst the approach of the ITE courses may be congruent with the "classic" curriculum, it makes no reference to the new competence based curriculum. This focuses on mathematics as a means to solve problems in particular contexts and then to apply what has been learnt in different contexts. There is no preparation for this approach and the curriculum is unfamiliar to the educational psychology tutors who teach mathematics methods.

The Tanzanian ITE syllabus for TTC is general and does not differentiate between upper and lower primary school. Pedagogic strategies for teaching mathematics are generic but with examples of how to teach taken from with number and algebra. Apart from this with no guide or text book tutors have to use their own understanding of mathematics. The primary school curriculum for each grade is not studied. In Tanzania changes in the primary school curriculum are frequent, but tutors remain unaware and uninformed of changes made in the syllabus or new text books introduced and even when they teach from 'the' primary curriculum, this is often out of date. This current curriculum for mathematics embeds the specific mathematical content that children are expected to learn as competencies by the end of each grade and is particularly clear about progression, as content area is systematically built on from grade to grade. The concept of moving children from pre-number activities to more complex abstract computations is clearly stated. It is also possible to discern pedagogic strategies needed to introduce number, such as using concrete objects to manipulate in various patterns.

Whilst Uganda has the same problem of a new thematic primary curriculum and a much older ITE curriculum which generically is not aligned with teaching with the thematic approach, in fact the alignment is somewhat better than in the other countries. It emphasizes practice as a basis for developing teachers' knowledge and that mathematical concepts need to be learned in specific contexts. The objectives of the curriculum thus support experiential rather than theoretical learning, though this is not consistently reflected in the various units nor is it in the presentation of the selected teaching content. Although many unit aims emphasize experience as a source of knowledge and understanding of concepts, some unit aims refer to competences not comparable to the practical experiences for learning mathematics implied in the objectives.

3.2.4 Challenges

Although the situation varies from country to country, a conclusion of the research is that in every case there is a discrepancy between what is required of teachers to teach the primary school curriculum and the preparation that they receive to do this from their initial training. Curriculum development at primary level is more frequent and more detailed than in teacher training, and more resources and more energy are mobilized for it. Teacher education and teacher educators need to be not just informed but also involved in school curriculum reform. This might go some way to increasing the relevance of teacher training and ensuring that newly qualified teachers are a progressive force. However as we have already noted, teacher education is often the responsibility of different parts of the system from the primary schools and the changes in the schools may often be quite frequent. Rather than attempting to harmonize the school and the initial teacher education curricula as separate entities, it would be better to see the study of whatever school curriculum was currently in operation as an important focus for the work of initial training. This would include not just gaining familiarity with the sequence of content, but also and crucially critically engaging with the approach to teaching and learning that the curriculum advocates and requires. In other words, the study might involve trainees not only gaining knowledge of what is in the school curriculum, but moving towards an understanding of why. This may then be deepened through contrasting and comparing with their experiences of primary schools.

Chapter 3: Learning to teach early reading: the contribution of initial teacher education

Literacy is, indeed, a first major step to most other forms of learning (UNESCO, 2006)

Reading opens doors to all learning (Reading tutor in a Primary Teachers' College in Uganda)

Four years of education are needed to achieve basic literacy (UNESCO, 2009) but after three years of schooling 70% of children cannot read more than a few words, a sentence or a short story in Kiswahili in Tanzania and Kenya or in local language in Uganda (Piper, 2010; Sumra, 2010; UWEZO, 2010). In Mali after four years of schooling over 40% of children cannot read a single word in any language (MEALN, 2009). Children who achieve early success in reading are more likely to stay in school, while those who do not grasp reading skills are in danger of early drop out, often in grade 1, and a relapse into illiteracy (Psacharopoulos & Woodhall, 1985; Chabbott, 2006).

This chapter describes and analyses how primary school teachers are prepared to teach reading in the early grades of primary school, which may begin to explain the above bald statistics of seriously low attainment in reading. It begins with a review of the international literature on learning to teach reading, how children learn to read in mother tongue and transfer to a second language, and pedagogies for teaching reading in large, resource-poor multilingual classrooms. The chapter then reports how teacher educators interpret and deliver the ITE curriculum for early reading, how trainees learn from teacher educators what reading is and how to teach it, the role the practicum has in their development and their access and understanding of the primary curriculum for early reading. The chapter then looks at how NQTs teach early reading in primary schools and the impact of this initial pre-service education on their practice.

3.1 What the literature says

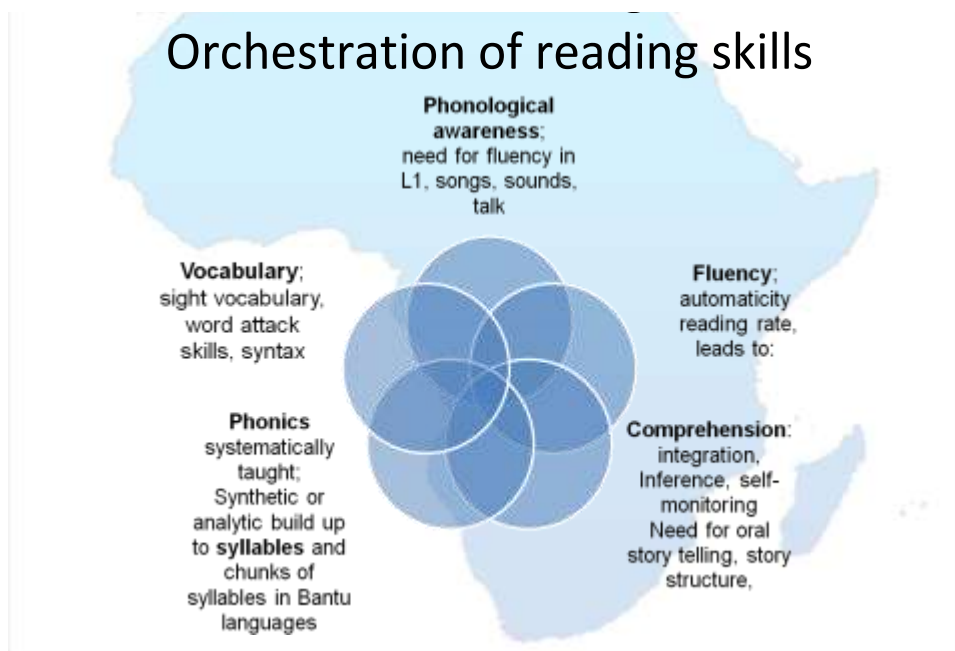
Readers read texts for a purpose with the expectation of generating meaning. To do this, they have to decode marks on a page (graphemes) which represent spoken sounds into words that join together into sentences to make continuous text and to imbue these with meaning so that the cognitive work involved in the decoding is worthwhile (Meek, 1994; Ehri, 2002). When a child begins learning to read integration of decoding and comprehension occurs through a teacher or parent connecting every day oral language with the written words; learning to read is embedded within the social and cultural contexts in which children learn to speak (Brice Heath, 1983; Stanovich, 1986; Street, 1999; Barton et al., 2000). According to the influential US-focused National Reading Panel, there are five key reading skills that children need to read – in English:

1. Phonological awareness (discriminating different sounds in spoken words)
2. Phonics (sound to letter relationship)
3. Fluency (ability to read orally aloud or silently with speed, accuracy, and proper expression and contributing to comprehension)
4. Vocabulary (acquiring sight vocabulary, inferring new words)
5. Comprehension (connecting sentences, inference and meaning-making) (NICHHD, 2000)

In African classrooms, phonics instruction is recommended as one strategy in the early stages of literacy acquisition, especially when the regularity of phoneme-grapheme correspondence helps the reader to recognize or decode new words, such as in Bantu languages like Luganda (Uganda) and Kiswahili (Kenya and Tanzania); being tuned in to tone and vowel length through an oral emphasis and linked to the deconstruction of a series of syllables is equally important (Trudell & Schroeder, 2007). Conversely, English and French, have a deep orthography where 26 letters are used to represent many more different sounds as graphemes requiring a variety of word attack skills that include but are not solely dependent on, a skilled and systematic understanding of phonics.

While decoding is often learnt first, these five reading skills are soon orchestrated simultaneously, working together in a causal relationship, the growth of one area supporting the others (Stanovich, 1986), although there is some difference of agreement amongst experts in terms of emphasis (NICHHD, 2000). Comprehension is the ability to interact cognitively with continuous text of a sentence or a short story to draw out meaning and create mental models of the text requiring a sight vocabulary, fluency in reading aloud or silently and knowledge of syntax learnt from the grammar of the spoken language (Ehri, 2002; Malatesha, 2005). Comprehension monitoring and knowledge of text structure can be taught to very young children through oral story-telling and picture books using multiple strategies such as questioning, summarisation, prediction, graphic organisers and clarification (Cain, 2011).

Figure 3.1 Skills of reading



A prerequisite for learning to read is spoken proficiency and fluency in the language being used to teach reading. Learning to read in a first language (L1) supports the transfer to a second (L2) whereas learning to read initially in L2 or even L3 will disadvantage learners, who may not have sufficient phonological awareness and spoken vocabulary to make sense of any approach (Commeyras & Inyega, 2005). Mother tongue literacy in multi-ethnic multilingual contexts has become a matter of concern to African educational policy makers, researchers and scholars in recent times who have expressed worry about the situation of mother tongue illiteracy prevalent in many African contexts. When schools overemphasize the use of English or French to the neglect of pupils' mother tongue, they also deny themselves their own culture, because mother tongues are rich cultural reservoirs (Bunyi, 1999; Commeyras & Inyega, 2007; Trudell & Schroeder, 2007). The language policy in the six countries in this study varied, but in those that have introduced local or national languages policies recently, our findings indicate a struggle with implementation owing to the need for more teachers fluent in local languages, knowledge of different orthographic structures, specific training in the teaching of reading with appropriate methods and scarcity of reading materials written in the local language. The high status attached to colonial languages from parents and community/district stakeholders also impedes local languages policies (Muthwii, 2004; Trudell, 2009). Even where the language of instruction is a national language such as Kiswahili in Tanzania and Kenya, many children have a different mother tongue. Some research claims that six to eight years of learning in mother tongue are needed for the full linguistic and cognitive benefits which may be transferred to L2 to accrue (Rubagumya et al., 2011). Significantly, findings from the Early Grade Reading Assessments in Uganda found that, *even a low level of oral reading fluency in mother tongue can be linked to comprehension* (Piper, 2010: p.4).

Table 3.1 Reading Expectations in the six countries

	Grade 1 Language of instruction and curriculum expectations for reading	Grade3 curriculum expectations for reading	Grade 4 language of Instruction
Ghana	English (or national language for NALAP) Read 4-5 short sentences of four words	Read text silently within a specified time, with correction pronunciation, stress and intonation and to answer simple questions	English
Kenya	Mother tongue in grades 1-3 in linguistically homogeneous environments. Elsewhere, choice of English or Kiswahili Read words/sentences/texts and read short passages	Read a passage, short stories, answer questions, retell a story to show understanding, read for pleasure	English throughout
Mali	<i>Level 1 (includes both grade 1 and 2):</i> 'Classic': French medium Begin to read simple sentences and reply to questions on the meaning and structure of a text 'Curriculum': 11 national languages (N) and French Read a simple text and reply to questions on a text, retell a story in their own words(N only) Decode a text using different strategies (N and F)	<i>Level 2 (includes both grades 3 and 4)</i> 'Classic': French Read different types of text with appropriate expression, give a summary of a text of 200 words identifying its main elements and respond to a text at a personal level. 'Curriculum': 11 national languages and French Read different types of text with appropriate expression, give a summary of a text identifying its main elements, transform dialogue into narrative and vice versa, personal response to a text..	French French and national language
Senegal	French: Read simple stories, cartoons and instructions in context and respond to them. Read and recognize globally common words and phrases.	French Fluent fast reading aloud, exercises begin with silent reading; comprehension seen as central in establishing correspondence between sounds, syllables, words and passages. Reading for pleasure a range of text types	French
Tanzania	Kiswahili Read short paragraphs of a meaningful story orally in class and answer questions	Read a longer story with understanding orally with correct pronunciation or silently.	Kiswahili
Uganda	Local Language where this is one dominant language; English in multilingual contexts Read 2 syllable words with double vowels and reading at least 4 words	Read short dialogues, stories, passages and answer questions	English throughout
RTI suggested global standard	Pupils to read with understanding a grade-level text by the end of grade 2 (Gove & Cvelich, 2011: 7) 'Reading with understanding is defined as a student's ability to both decode (translate print to sound) and know what they read, at the level of words, simple phrases and sentences'		

This therefore reflects a substantial knowledge base for beginner teachers of reading, one not easily acquired just theoretically or practically. Reading teachers also need to be critically engaged with the primary curriculum, teacher's guide and text books and be knowledgeable on pedagogies appropriate for large resource-poor classrooms. A child-centred, constructivist approach may not always be appropriate in African classrooms if there is no 'cultural framework' to support this (Vavrus, 2008: 306). It may be more productive to consider how to vary more traditional teacher-centred approaches that work with very large groups of very young children in resource-poor classrooms such as group work, paying attention to learners and team teaching (O'Sullivan, 2004; Barratt, 2007; Nakabugo et al.,

2007; 2008; Vavrus, 2008; Wedin, 2010). They also need to have a set of benchmarks that pupils are expected to achieve in reading by the end of each year. The study found a mismatch between what the primary curriculum specified pupils should be able to do, what teachers said they expected, actual teacher practice, and pupil performance/attainment. In the case of the last two the mismatch was often very striking. Low expectations of pupil attainment wastes pupil time, and their teachers', and parents' resources and patience; overly high expectations may result in pupil disengagement and unfairly label many as underachieving. Both scenarios can be a direct cause of drop out in the early grades.

RTI International's work with literacy has suggested a 'reasonable global standard would be for students to read with understanding a grade-level text by the end of grade 2', which is further explained as: 'a student's ability to both decode (translate print to sound) and know what they read, at the level of words, simple phrases and sentences' (Gove & Cvelich, 2011: 7) (Ibid). Each country has some kind of standards or benchmarks as identified in their primary curriculum, as in the Table 3.1. These country expectations are often not however specific standards or milestones, but are implied in the objectives set out in the primary school syllabi. They may prove to be either appropriate in providing guidelines for practising teachers or far removed from the reality of how teachers teach and how young children learn to read in each country.

All expect that by the end of grade 1, pupils can read a short sentence of at least four words and by grade 3 read and understand a short text assessed through simple questions. Mali and Senegal have the most detailed and ambitious expectations including comprehension of a wide range of texts and reading for pleasure with personal response, while the others focus on stories and passages. The reading of connected text of more than one or two sentences making up a short story or account is therefore important for the end of grade 3. Literal, direct inference and skills of deduction may need to be taught to attain comprehension here.

3.2 Tutors and the teaching of early reading

3.2.1 Tutor Knowledge of Early Reading

Tutors of early reading were rarely experts in the field through their experience or training. Those who had training in language were mostly from a secondary background while those who had been primary teachers had had little theoretical grounding. Tutor knowledge was focused on two main approaches to reading of whole word 'look and say' and phonics in Ghana and Kenya or a synthetic phonic to syllabic to word approach in Tanzania and Uganda although tutors were also aware of other approaches, citing the syllabic, alphabet and 'eclectic' methods. In Francophone countries learning to read a text involved going through a series of steps that included both analytic and synthetic phonics which tutors were familiar with but began and ended by teacher and pupils making sense of a text, stages that some tutors were less familiar with. In Mali teaching methods tutors had no background in reading. Tutor access to and engagement in the primary curriculum for reading was not always guaranteed, so that tutors' understanding of progression in reading was based on either the ITE curriculum or their own knowledge base, and did not always coincide with the objectives in the primary curriculum. One quarter of tutors in Ghana and Uganda thought that comprehension was for upper primary only, even while this is a stated benchmark for grade 3 in both countries:

Early readers need to be trained in systematic reading; they can start with letters, words, pictures, then later for upper classes stories could be introduced. (Tutor in Uganda)

Knowledge of systematic phonics and how to teach it is weak in the Anglophone countries despite the emphasis on this in the ITE and primary curriculum. However, tutors in Uganda were aware of this gap and, in Ghana, of the importance of combining the two approaches of phonics and look and say:

there are some words you cannot use the sound (to teach), for example, words like 'the', we call it look- and-say'....[the teacher has to] 'take them a step forward, by giving them the phonic method ... then you want them to be independent readers. (Tutor, Ghana)

Extensive knowledge of a range of decoding reading skills in conjunction with fluency and comprehension was not apparent or articulated, nor were early pre-reading skills of phonemic awareness, print concept and oral language discussed by the majority of tutors. Awareness of reading and language learning theories to support their teaching of early reading was also cited as an area that needed strengthening.

3.2.2 Tutors' pedagogical content knowledge

The concept of a systematic, set sequence of steps in the teaching of reading was universal amongst tutors. The method and steps varied amongst the countries from the synthetic build up from vowels and consonants to smaller and then larger syllables and words in Uganda and Tanzania, look and say or/and phonics in Kenya and Ghana or the global/mixed approach in Mali and Senegal. Tutors in Ghana discussed a three step reading lesson that might be more appropriate for slightly older children but where the reading of connected text was central: (i) preliminary reading stage where new vocabulary was taught with pictures, demonstration or simple explanation, followed by pronunciation drill (ii) the actual reading of a short text with prediction exercises and the (iii) post-reading stage using question and answer to derive text meaning. Ugandan tutors combined methods and several discussed the importance of teaching oral language through song, chants and rhymes before reading letters. Drilling and repetition as pedagogic approaches were voiced by tutors in Kenya, Ghana and Tanzania as important in getting pupils engaged and in memorising letters and words:

They [Trainees] need to understand that reading requires a lot of imitation and repetition and therefore they should emphasise on the words they teach. They should drill the learners to understand a word before they introduce sentences. (Tutor, Kenya)

While drilling might have a place in language teaching, research has shown that it often deteriorates into mindless chanting rather than one of many strategies to encourage fluency and understanding (Bunyi, 1999; Opoku-Amankwa, 2009; Wedin, 2010). Even in mother tongue or a national language, drilling was viewed as a key strategy beginning with mastering oral language:

....so the teacher should start with the skill of listening. Thereafter he gives the skill of talking, followed by the skill of reading, then writing. In each stage he (teacher) should drill the skill until the pupil masters it. If the teacher will go like that, will be in the right track. (Tutor, Tanzania)

Tutors in Mali teaching on the accelerated program ('SARPE') explained in detail the six step approach that moves from a text level approach to analysis and extraction of the key word, syllable and sound and a return to the text for a synthesis focused on meaning and interpretation:

*Each stage also has its sub-stages and elements. When I take **Stage I** for example, it is called "discovery of the key sentence". ... **Stage II** is exercise, reading games. **Stage III** is going from the keyword analysis to the letter we study through the syllable. **Stage IV** is the synthesis where you put the syllables in a different order and ask the child to make words with these syllables. You can also put the syllables in columns. **Stage V** is another reading game, that's where we will enrich the vocabulary of the child. We show him pictures and ask him to name each picture. That's how we enrich the vocabulary of the child. Now **Stage VI** ... is the reading of the text. It starts with silent reading. After, there's interpretation and understanding. (Reading tutor, SARPE, Mali – emphasis added)*

While this approach systematically encompasses all five reading skills orchestrated together (Stanovich, 2000; NICHHD, 2000) the activities of each complicated step are foregrounded rather than the theoretical rationale behind each one. Tutors in Senegal also taught the mixed approach in which both a global and a phonic or syllabic approach were used and where the importance of building up a 'word bank' was voiced by tutors. The specific role of fluency in developing and contributing to comprehension was not well articulated or understood. Comprehension strategies remained limited to prediction and question and answer while some tutors in Uganda, for example, focused on developing reading materials and print concept rather than synthesising materials and comprehension strategies. In Ghana, however, tutors complained that trainees sometimes skipped micro-teaching tasks and sessions focused on the preparation of teaching resources because these were not examined.

3.2.3 Reading tutors' knowledge of multilingual reading theory and practice

In the ITE curriculum in Senegal 'Management of a bilingual class' is a key competence, but there was little evidence of tutors addressing it and the curriculum assumes that reading is done in French. Elsewhere local languages policies in the primary curriculum were often ahead of what went on in the colleges. In Mali a growing number of schools (over a half) are officially using the new curriculum which begins with local languages but training assumes French as the language of learning. While the knowledge needed to teach sounds in L1 and additional sound/letter relationships are in the Kenyan curriculum, for example, tutors have little knowledge or experience of how to teach reading in L1 and its links to L2 and/or the language of Instruction (LOI). In terms of professional development of tutors, one Primary Teacher's College principal in Uganda explained that they *'assume that language tutors have undergone training in teaching reading in the respective language, although here the local language tutor teaches reading in English as well.'* This lack of professional development was exacerbated when tutors themselves did not necessarily speak the national language of the region or were fluent or knowledgeable enough to teach reading in it. Some tutors in Kenya and Tanzania had negative views on the role of L1 with L1 interference seen as problematic rather than as a resource to use in multilingual classrooms. Code-switching was discouraged by tutors in the primary classroom in Kenya and some in Senegal and Mali. What was missing in all six countries was tutor knowledge and practice of realistic strategies to teach reading in an unfamiliar language – French, English or Kiswahili – to pupils whose understanding of those languages is negligible.

3.2.4 Tutor practice in the teaching of early reading

Tutor practice in reading was as varied and uneven as their PCK of reading, but all taught the sequence of reading activities mostly through simulation, in Mali almost exclusively, or lecture mode and were constrained in part by teaching large numbers of trainees in small classrooms sat on long benches. Sessions were tutor-led often to ensure curriculum coverage, as were some of the simulations, in contrast to the specifications of the primary curriculum that advocated a more child-centred approach. Simulation without critical discussion of the wider contexts in which children learn to read using real case studies meant that trainees were always themselves learning within a contrived, 'ideal' environment. 'Methods' for teaching reading gained prominence in the weeks leading up to the practicum only, with subject content otherwise dominating tutor practice. Tutors exemplifying interesting practice ensured trainee participation through singing, clapping, choral answers, group work, critical discussion and theory used to inform. One tutor in Uganda used group work to develop teaching and learning materials (TLMs) based on pictures of objects, advertisements of different products and services, short sentences about events, rhymes both in English and local language, tongue twisters, riddles, short stories and simple nursery songs. Other tutors' practice was more teacher-led with some effort at illustrating how trainees could teach with group work focused on activities to do with children rather than how the activities could teach a specific reading skill in depth. The cognitive pace here was slow and trainees were often disengaged. Poorer practice contained mostly teacher talk, was not systematically developed with the tutor skipping from one topic to another and much homework or research given. Others just used the chalk board and large pieces of paper for trainees to write down activities. Several tutors had a negative view of their trainees, constructing them as lazy, reluctant to read, lacking creativity and unwilling to make teaching materials even while they did not bring materials into their own teaching.

Connecting words to longer text such as full sentences or short stories was rarely observed in East Africa. However, tutors in Mali and Senegal in principle taught comprehension from the whole text, but sometimes did not follow through on the final synthesis of meaning in their sessions, dwelling more on decoding especially in Mali. Similarly, few lessons were observed where tutors explicitly taught trainees to make the connection between what was read and what was understood by children and how to diagnose misunderstanding or misconnection. In Ghana, for example, lesson demonstrations did not address difficulties that some children might have in learning to read and what actions/steps teachers would have to take to overcome difficulties. There is an implicit assumption among tutors that learning how to teach early reading will take place in schools:

Learning about how to teach early reading is completed in schools not PTCs, through experience, through CPD and through other teachers. Little really is learnt at PTCs (Tutor, Uganda)

As identified in chapter two, the amount of time available for teaching reading was very limited everywhere. Tutors could only give a basic introduction therefore to the teaching of early reading. As one Ugandan principal put it: *'You cannot train the teacher to do so much in just two years!'* One group of Senegalese trainees considered that their training was:

'very fast, but well organized . the trainers cannot give us everything but they do their best. They give us the most [they can]: the rest is up to us to do research' (Trainee focus group Senegal).

This sense of a rushed and superficial training in how to teach early reading was seen in the trainees' and NQTs' knowledge, practice and understanding.

3.2.5 Challenges, gaps and issues

Reading tutors' knowledge of reading is uneven and for most it remained an abstract activity rather than pedagogical content knowledge developed through actual practice as primary schools teachers. As such they relied on text books or the primary school curriculum for reference materials if they could get access to them. A body of knowledge has accrued around the teaching of decoding for lower primary focused on sounds, syllables and words taught through a limited number of approaches. Comprehension and reading for meaning strategies were rarely observed or were seen by tutors not to 'count' as 'early reading' or to be too difficult for younger children. Tutors assumed that trainees would be able to adapt the knowledge they received into pedagogical content knowledge appropriate for the youngest children and teach to an idealised version of the primary classroom rather than contextualising this within large, resource-poor multilingual classrooms.

3.3. Trainees' knowledge and understanding

3.3.1 Trainee knowledge about reading

Trainees reflect the same approaches to teaching reading as their tutors. Reading was seen everywhere mostly as a synthetic activity where children learn to read through acquiring graphophonic knowledge, syllables, words and sentences in consecutive steps rather than these skills working together simultaneously. Although in Senegal trainees, echoing their tutors, talked of the global approach to reading, it was again as a series of steps where the phonics were considered most important. Reading rate, fluency, acquisition of vocabulary and comprehension were not a major part of most trainees' model of reading. Trainees in Ghana and the East African countries found systematic phonics laborious, with trainees in Ghana finding it challenging to deal with letters with confusing sounds (e.g. /c/ and /k/), reflecting a level of superficiality with how the method was to be used in teaching – and indeed tutors' poor knowledge of phonics. Trainees everywhere, like NQTs and more experienced teachers, found sentence and text level skills such as syntax and story structure more difficult to teach, with a quarter considering understanding overall meaning of a story or poem unsuitable for the first three years – again echoing their tutors. This suggests that they think learning to decode can take three years and needs to be taught *before* attempting to make sense of longer texts, though all the primary curricula advocate embedding decoding within the reading of dialogues and stories. It was noteworthy that trainees in Uganda taught by a tutor who brought in a range of reading materials linked the practice of reading to role play and comprehension:

You can't work without poems, plays, because children need to read and understand them and then you ask them to role play in order for them to understand the meaning of those words. (Focus group, Uganda).

3.3.2 Trainees' pedagogical content knowledge

Common for all trainees was the their difficulty in thinking of alternatives to the set sequence in a reading lesson – i.e. actively drawing on a combination of approaches depending on the specific set of learners, and what was to be taught. Ghanaian trainees, for example, focused either on pronunciation or on attaching meaning to pictures and whole words – look and say – but not a combination of both methods in the same lesson:

I would first of all, teach them sounds of the various letters. Then I would go through the two sounds and after that I would go beyond three, four ... then I would introduce them to the reading so that when they are reading they would not find it difficult to pronounce certain words. (Focus group, Ghana)

As reflected in their emphasis of decoding rather than fluency and comprehension, trainees from Mali discussed the steps needed to get to the sound without reference to the crucial final focus back on comprehension:

The first thing to do is to identify the character from the picture. After that you bring out the main idea of the sentence using the picture. Then, from the picture, you bring out the sound of the letter you want them to learn (Focus group, Mali)

Trainees understood the concept of working from simple to complex and of using concrete or real-world representation to teach new vocabulary and some drew on Piaget's stages of development. What was missing in their discourse was knowledge of why pupils need to clearly see letters or have clear sightline of longer text or the importance of print environment and ways to produce, manage, use and store teaching aids for large, multilingual classrooms.

3.3.3 Language issues

Trainees were themselves not always familiar with the local language that they might have to teach. Even while expressing concern about their readiness to teaching reading in bilingual or multilingual classrooms they had a more positive approach. In Uganda trainees are trained to teach reading in 15 local languages yet a significant proportion were still most confident teaching reading in English. One college principal suggested that trainees *'are not fluent enough in the local language to effectively teach using it'*. Trainees in Mali expressed their wish to work in French medium schools because they had received no training in anything else and considered themselves illiterate in local languages. At one college in Ghana only 70 out of 300 trainees chose to study methodology in Ghanaian language. In Kenya, trainees were concerned about mother tongue influence and the challenges of getting pupils to understand English when code switching was discouraged by tutors. Significantly, however, they pointed out that the meaning of a passage or word could be enhanced by the use of simple explanation in English or the local language. Overall there was little sense from trainees of the complexities of learning to read, especially in a second language, and that understanding crucial links between first and second language might be an important gateway to developing reading. Nor was there discussion of the potential anxiety and 'language shock' some pupils might experience in learning/reading a foreign language, and what the implications would be for teaching it (Opoku-Amankwa, 2009).

3.3.4 Trainees and Teaching practice

Trainees generally viewed the practicum as beneficial, though in some cases too short or not well enough organized. For the majority of trainees the practicum remained at a superficial level, a one-off event rather than an accumulation of learning to teach over many lessons. Some never got to observe or even teach an early reading class with too many trainees sent to the one, often local school. Indeed, trainees in Tanzania are rarely allowed to teach the lower grades on teaching practice at all because they are not seen as knowledgeable or adequately prepared by the college to do so. They were sometimes reluctant themselves, reacting against what was seen as the lowly status of lower primary teaching, seen as a woman's job. Trainees pointed to some poor reading practices observed while on their practicum, causing confusion between the way they were taught in the college, with the 'ideal' method, and practices that were commonplace in school.

What you learn in theory should be practised on the ground but sometimes the theory can be very different from practice. Personally I rely on the practice because things are more real in the field (Focus group, Senegal)

In Senegal, for example, trainees said that practice schools' teachers in often missed out the parts of the reading lesson that related to comprehension. Tutors, especially in Mali and Tanzania, noted that trainees revert to the way they were taught to read rather than adopting the new practices learnt at college: trainees on the practicum] *'teach what seems easiest and generally they do not feel able to do what they are taught to do'* (Tutor, Mali). In what should

be the key learning context, trainees remained unguided, rarely being given opportunity to observe the best experienced teachers and with little systematic supervision or mentoring, with brief contact by tutors in the Anglophone countries and none Mali and Senegal. .

3.4 Newly Qualified Teachers

This section analyses the impact of their training in reading on NQTs' development as reading teachers, followed by their practice in teaching early reading in actual classrooms. Analysis is supported by use of quantitative data that illustrates differences between trainees and NQTs.

3.4.1 Significance of initial teacher education in the teaching of early reading

Research elsewhere suggests that NQTs may learn to conform to the very local class and school environment, hierarchies and practices in use, which may, 'wash-out' the impact of their training (Zeichner & Tabachnik, 1981; Westbrook et al., 2009). In this study, however, NQTs claimed that ITE remained the most significant source of their understanding of teaching early reading (see table 3.2):

Table 3.2 Where NQTs claim they developed their best understanding of teaching reading?

	Ghana	Kenya	Mali	Senegal	Tanzania	Uganda	All
	%	%	%	%	%	%	%
In-service training	1	11	27	23	14	7	16
Other teachers	10	6	8	22	10	20	12
Training College	79	60	48	33	64	57	56
Work in Schools	10	23	17	22	12	16	17
Sample size	155	152	213	156	187	56	919

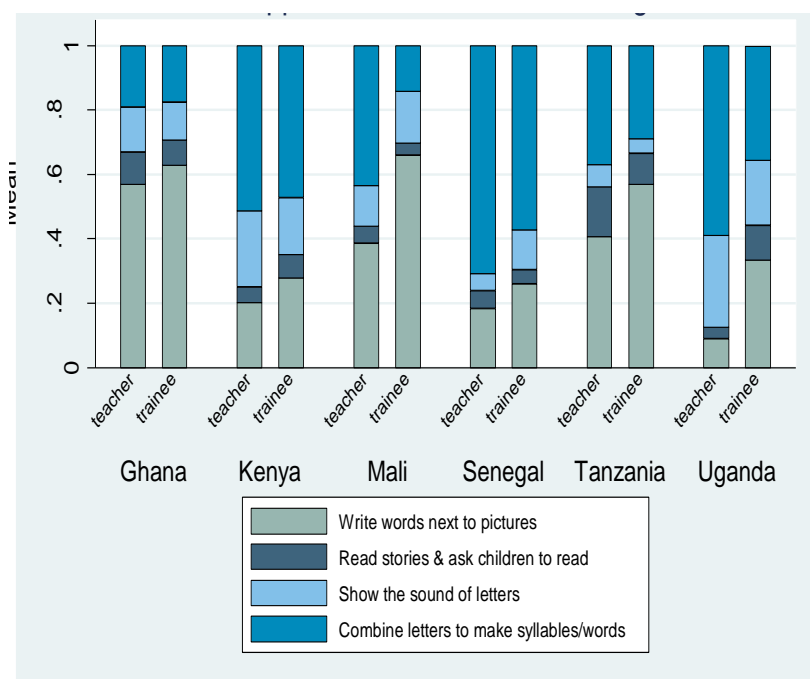
- The influence of ITE was highest in Ghana where NQTs in this study were those in their practicum 'out' year and so had little experience or exposure to other teachers' practices or CPD.
- The influence of their pre-service education remained very significant for 64% of Tanzanian NQTs as they had little experience of teaching in schools or access to CPD to modify this
- 60 % of NQTs in Kenya reported that they had best developed their understanding of reading at college although experience in schools was greater at 23%
- The influence of more experienced teachers in Uganda was significant at 20 % reflecting the greater incidence of organized in-school CPD
- With little time spent in college in Senegal, the influence of ITE was low at only 32% with CPD, other teachers and work in school being equally important.
- In Mali 48% of NQTs pointed to their training as most important but the in-service training with radio lessons of PHARE and the initiation to the curriculum was relatively strong.

3.4.2 Mentoring/induction of NQTs

Overall, there is little systematic mentoring of NQTs or induction and they are left to develop their practice of teaching reading on their own. Ghana has the most formalised system for the OUT year and NQTs are assigned mentors. However, these may not have themselves been given guidance and were sometimes absent from the lessons they should have been supporting in. NQTs in Mali and Tanzania are dependent on the quality and willingness of more experienced teachers to induct them at a later point into teaching the youngest children.

3.4.3 NQT Knowledge of reading

Figure 3.1 NQTs most favored approach to teach reading.



Survey data showed that both trainees and NQTs considered that a good teacher of early reading meant: being a good reader themselves in the language; giving a range of strategies to make sense of words and reading aloud in the classroom. Telling lots of stories and linking them to text was not considered to be as important nor getting children to memorize words and sentences. However, in part contradiction to this, when asked what the one approach would be in their planning of early reading respondents most often chose either the 'look and say' approach of writing whole familiar words on the board next to pictures and ask children to repeat many times after the teacher or combining letters to make syllables to make up simple words. Reading stories and asking children to read aloud was the least common approach selected:

- In Mali the global approach to reading is interpreted as being necessary at word level in combination with a phonics-to-syllabic approach whereas at sentence / text level it is rare.
- Similarly, in Senegal, combining letters to make syllables or words is seen as the key method, despite the emphasis on a global approach in the curriculum at both ITE and school level, a finding corroborated by observational and interview data.
- NQTs in East Africa are more likely to use a phonics-to-syllabic approach than trainees.
- The importance of stories in the primary curriculum is reflected in Tanzanian NQTs greater choice of this option.
- In Ghana the 'look and say' method, also seen in observation and interview data is dominant.

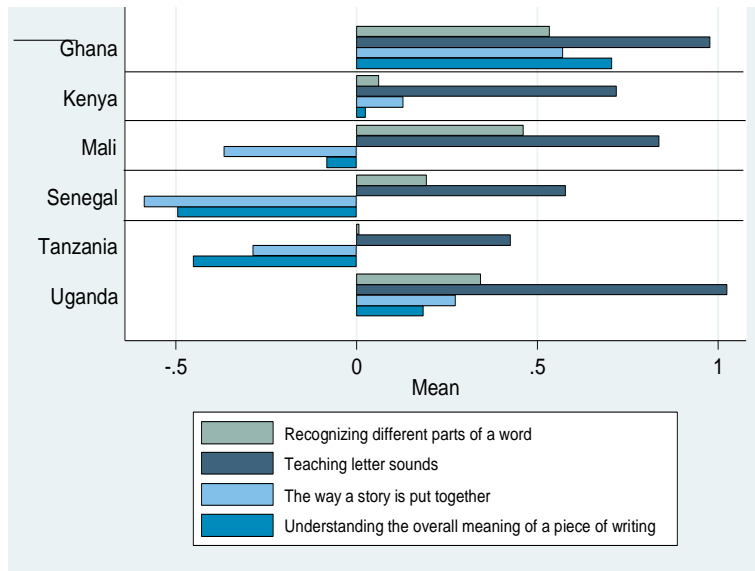
Weaknesses in the teaching of sounds at pre-service impacted on NQT knowledge and practice despite the apparent frequent use of the method with children. This could lead to difficulties in applying the method and linking them to pronunciation as this teacher explains:

The pronunciation of the sounds and the letters ... that is very difficult. You can see some letters having different sounds but when you are pronouncing them it will be also different. So that confuse you the teacher. Even in college it was difficult and yet they did not have enough lessons on it (NQT, Ghana)

The emphasis given to phonics, despite in most countries a weaker knowledge of it, is a key finding. Alternative means of decoding such as using analytical and synthetic syllabic, syntactic, text or visual approaches would support and in some ways overcome NQTs poorer knowledge of phonics, or, for example, using rhyme and analogy to recognise whole words and for spelling in Kiswahili in Tanzania and Kenya (Trudell & Schroeder, 2007). NQTs throughout seemed to favour a narrow range of methods of teaching using what they are familiar with and find easiest - according to the survey data: letters sounds; joining sounds to make syllables; linking stories, actions and pictures with writing and punctuation are reported as easy to teach: Teaching whole text methods was seen as difficult everywhere except Ghana and especially difficult in Tanzania, Mali and Senegal, possibly because they had

more often attempted it unsuccessfully as the training curriculum in these two countries suggested that it was something teachers should be doing (see figure 3.2). With a limited number of ways to decode, pupils had less chance of making an early and fast sound-letter association, that important breakthrough that then allows the reader to foreground meaning in what is read (Stanovich, 1986). In African classrooms this is compounded by a lack of reading materials or consistent use of the chalk board to provide longer text for pupils to practice reading with.

Figure 3.3 NQTs perceived difficulty in teaching reading skills



Respondents were also asked to state how frequently they taught particular skills of reading in the first three years of primary school which confirm a more frequent use of decoding albeit a slightly wider range of strategies. Overall, NQTs found syntactic and morphological approaches to decoding more difficult, as well as reading aloud (fluency) and reading for meaning but they also had less confidence in teaching letter sounds than might be expected. As a consequence, word level skills drawing on an initial simple phonics approach as a step up to a synthetic syllabic and whole word approach are more commonly taught on a daily basis. The primary curricula for all countries however specifies that pupils

should be reading and comprehending short texts by the end of grade 3 with Mali and Senegal referring to a rich variety of texts to be read including non-fiction, comics and short stories. The continued focus on word level skills suggests that learning to read is perceived as an on-going activity up to grade 3 with reading for meaning and comprehension of longer texts, pupil self selection of texts and practice of reading continuous prose more often taking place in grade 4 and upwards. This will result in pupils decoding words divorced from their meaning and from longer texts such as stories that give purpose to that initial decoding. Findings consistently indicate a profound ill ease with the key purpose of reading – that of understanding what is read an issue borne out by the observation data. The findings also reflect what teachers aspire to do rather than what they do in practice and need to be considered in the light of the results of pupil such as the EGRA tests.

3.4.3 Language issues

NQTs' knowledge and practice in using local languages for their teaching of reading was uncertain and confused. Code-switching became a survival mechanism rather than a planned strategy for their multilingual classrooms. Observation and interviews in Ghana, Kenya and Senegal showed NQTs most often using a combination of English/French and local languages, the latter for explanation and the teaching of new vocabulary but not for decoding of print. In Senegal almost all teachers observed used the national languages even though less than 7% in the survey said they felt comfortable teaching in national language. Some used it to move from one lesson stage to another and some to explain content or a concept. Many teachers observed used French as if their pupils had already acquired it orally, which was also the case insome Malian classrooms. Where code-switching was well used, however, pupils were more engaged and active and sought meaning in the texts such as the bilingual lessons in the NALAP classrooms in Ghana (see below). In Kenya, however, NQTs said they were not encouraged not to code switch, even while many did:

Learning to teach early reading and mathematics

It is not allowed. When you are having an English lesson, you are not supposed to use Kiswahili at all, at all. Hata ni makosa kubwa sana (Kiswahili for it is a very big mistake). In the college, one was penalized for committing such a mistake. You are supposed to teach in English because they want them to get English (NQT, Kenya)

This attitude was also encountered in Mali and Senegal, where it was noted that some NQTs confused using the local language to make sense of the French text that was being read with the provision of question in that language to which a pupil could provide a correct answer and so allow the teacher to move on.

In Uganda, there was an understanding that teaching English and local languages require different approaches, even to be taught by different teachers to 'avoid confusing pupils' (NQT, Uganda) with pupils using local language first in both reading and writing. Evidence of code-switching in Uganda was strongest in urban schools where one NQT said that English was used by teacher and pupils but the teacher asked pupils for local terms for items or provided one when pupils were unable to give one. Language policy appears to be still in a transition state and 'works' in areas where there is one main language and where the teacher is fluent in it: otherwise English/French is used as medium of instruction in multilingual areas with some code switching.

3.4.4 NQT practice in the teaching of reading

Looking more specifically at the data from observation and interview, most NQTs' criterion for a good lesson was that they had completed the steps set out in the teaching sequence as learnt at college without any critical reflection as to whether their pupils had engaged and learnt anything. NQTs in East Africa and Ghana turned to the guidance given in the primary syllabus which did not always match the way they were trained. In Tanzania inspectors and head

teachers insisted on a literal interpretation of the syllabus as in this quotation from an NQT:

I followed the syllabus because the syllabus says we should first teach the meaning of vocabularies and then let the pupils make sentences using those vocabularies. It says later on that they should study silently the poem and then answer questions from it. Later they should read it aloud. That is what the syllabus directs. (NQT, Tanzania)

This syllabus directs a more text level and learner-centred approach rather than a word level one teaching vocabulary, fluency and comprehension rather than a word level approach. In the interviews with NQTs or observed lessons they rarely raised issues or responded about the learning outcomes or skills that pupils were expected to learn by the end of each lesson or each year as spelt out in Table X. The objectives in the primary curricula were often couched through activities rather than standards, benchmarks or expectations. As such the standards pupils should be reaching may not be

Examples of good practice

Paired reading

I put one who knows how to read with one who doesn't know. One pupil acts as a teacher to the other. Now they know themselves. I am a teacher of this, I am a teacher of this one, I am a pupil of so and so. Sometimes, I call the two to the front in the afternoon and sometimes I tell the 'teacher' to dictate to the 'pupil'. I tell him/her to dictate five words and you find one dictating and the other writing. Pairing them has helped me a lot. They learn from each other and they are free and I also monitor them. I go monitoring those who are reading and also I motivate those now who are doing teaching the others. I am coming up with my own teachers from that class. Each group has a 'teacher' (NQT, Kenya)

Confident pedagogical content knowledge ensured that pupils were engaged and learnt as in this lesson from Ghana:

What was peculiar about her lesson was that while the reading aloud was going on, she identified pupils with pronunciation and word-recognition difficulties and provided a remedial activity for them by teaching the initial sound /p/ in pin; the end-sound in 'pin' and 'pig', the sounds /i/ and /n/. She then blended them to read 'in', pin, etc. After this, she drilled them repeatedly by pointing randomly at words which were easy and difficult for the pupils and asked the pupils to read them individually, in groups and as a whole class. At the end of the reading, the teacher stuck sentence cards on the board and asked pupils to pick word cards to match them to words in the sentences. (NQT Ghana)

In teaching the consonant sound 'w', one NQT in Senegal used real objects and a context within which to embed the learning:

I called the pupil who was called Waly. I gave him a bucket and told him to 'go fetch water at the well' after I said 'who fetches water from the well, who?' They say 'Waly fetches water from the well'. Every time I try to get a concrete situation so that pupils can properly fix the sound (NQT, Senegal)

All three NQTs in these examples construct teaching through a problem-solving approach that then propels them to use imaginative methods appropriate for the content and the pupils in front of them.

easily discerned by tutors, trainees or NQTs. Therefore, they are likely to teach reading without targeting any particular competences the learner should be able to exhibit at the end of a grade level. Moreover in few classrooms observed was it apparent that the pupils were likely to meet these standards and NQTs expectations were much reduced. This was especially so in Mali where NQTs were faced with the greatest discrepancy between what they had learnt at college and the reality in schools with especially in the bilingual curriculum, classes.

Lessons began in Ghana and East Africa with a song or question and answer, learning of new letters, letter blends such as b – ba, be, bi, bo, bu or words or syllables through teacher demonstration using a chalk board, manila charts or flash cards with whole words on. Groups, whole class or individual pupils repeated these orally, being drilled or coming to the board to write. This was followed by exercises and marking by the teacher moving around the class or pupils coming to her desk. Songs, rhymes and riddles were often used in to teach phonological discrimination, to motivate learners and to signal lesson transitions. NQTs in Mali knew the set steps of the global approach but in many cases omitted those steps which did not conform with the syllabic approach of their own schooling so that practice was similar to East Africa with a *move from words to diphthongs, to syllables with diphthongs, reading the sound and writing on slates* (NQT, Mali). They suggested that the activities focusing on the whole text and comprehension appeared only to work with those children who knew French already. In Senegal the majority of NQTs wrote a sentence to deconstruct on the board read by pupils silently followed by an analysis of the key phrase or word:

There is reading the whole word, there is isolation of the sound, syllable formation and association. ... we delete the first 'pa' [digraph] by making them repeat 'p plus a equals pa', then reading the sound 'p' with different scripts and in capitals (NQT, Senegal)

This was sometimes followed by a repeated silent reading of the text and comprehension questions around the text but more frequently this stage of the lesson was not reached. In some lessons across the different countries the pattern could be quite fast and cognitively engaging, with songs performed more energetically to gain pupils' attention, or a greater mix of methods to engage pupils in word or sentence meaning from the beginning such as using stimulating teaching aids. Some of these 'best practices' indicated a more learner-centred approach than the methods learnt at college with effective use of group work with large classes and indicate the influence of the school context in the NQTs' professional development.

Poorer practice, however, was often observed in the study where a limited range of strategies were used, mostly at word level. The assumption that children would memorize words through repeated drills was a dominant pedagogy:

Reading once they may not comprehend the passage, even twice they may not but the more they read, the more they understand because you realize as they are reading some of them would get lost and because they are children, we realize that they also learn through repetition, keep on asking them to repeat because they learn by repeating (NQT, Kenya)

Formative and diagnostic assessment strategies to check whether pupils' fluency and comprehension have improved as a result of repetition were not employed. In lessons observed pupils could go through such lessons without reading, hidden behind another child, mouthing the sounds of the letter or word or copying it down without ever grasping its meaning, and 'lost' because the teacher was not explicit enough in linking sounds with text or ensuring word meaning through drawing a picture or the word or showing a real object or checking pupils understood. Often some pupils copied down words so slowly that they failed to move onto the next more cognitively challenging task of generating their own words or phrases (Opoku-Amankwa, 2009; Wedin, 2010). NQTs in the interviews considered delivering the teaching as their role, whereas it was the children's responsibility to ensure that they understood. This links back to the training they received where analysing what might prevent children from learning and shaping or altering instruction to ensure learning was not a skill many NQTs had learnt from their tutors or observed from experienced teachers on practice. When asked why she thought the children could not read, a fairly typical view was expressed by this NQT in Ghana locating the problem with the children and not with her strategy:

They cannot read so unless I use the reading aloud. I read and they read after me. I allow someone to read and they read after the person. They are very slow learners and if you don't take care, you wouldn't mind them again. Look at the way they were reading. If it wasn't you here ... I will use the cane (NQT, Ghana).

The difficulties with teaching longer texts had a cumulative effect where there appeared to be a separation between 'reading' lessons focused on decoding and lessons where pupils read actual books and so practised reading. In Uganda after lunch teachers brought in books or there were library lessons but these were not observed to be used in proper morning 'reading' lessons. The Matthew effect was often seen whereby pupils who were able to decode and read more fluently than others practised their reading and so improved while the majority avoided learning or were not identified as misunderstanding (Stanovich, 1986). In Ghana, observed lessons focused on the reading of longer texts included model reading by the teacher or a more proficient pupil, reading aloud by the whole class, in rows and individuals and in a few instances, silent reading by some grade 3 pupils. However, the emphasis was on the pronunciation of English rather than fluency leading to comprehension. Teaching and assessing comprehension relied upon the teacher posing questions with pupils responding or, as in Mali, predicting the title but they were often not left to find the answers themselves. In Senegal, observed lessons showed that NQTs did not provide a hook or motivation for children to read the text at the beginning and only gave them a short amount of time to read the text silently so that the study of sound and identification of the isolated sound became the key purpose. Alternative ways of ensuring comprehension such as pupils asking the questions of the text, summaries, or drawing pictures or diagrams of the text or relating a text to pupils' own experience were rarely if ever seen in NQTs (Cain, 2011). Low expectations were common in all places though NQTs in Tanzania had a strong grasp of the concept of inclusion and were favourably disposed to adopting pedagogies appropriate for supporting the less able or disabled from the primary curriculum.

3.4.5 Use of teaching and learning materials

The importance of print concept was visually apparent in at least a third of the NQTs' classrooms with visual aids and charts on display. Some NQTs used pictures in text books, or a few prepared their own charts, flash cards or sentence cards, teaching the meaning of the key vocabulary items in the texts and drilling them, then calling out the words randomly for pupils to identify. Some NQTs however did not allow the pupils to interact with the word cards but simply flashed them whilst they pronounced the words, and put them aside without going back to them throughout the rest of the lesson while for others enthusiasm for producing and using TLMs seemed to have waned. Some just used the chalk board extensively or relied solely on the pictures in the text books. There was some reliance on mass produced and given materials as in NALAP in Ghana. Creation of home-produced teaching aides to make a print rich environment and to use these integrally to teach reading was rare.

3.4.6 Challenges, gaps and ways forward

NQTs claim that training college remains the most significant source of NQTs professional development in the teaching of early reading. Their practice reflects the steps they were taught in college which they appear to transfer to those given in the primary curriculum but these are delivered with little criticality or concern for their pupils' attainment or adherence to expectations of attainment. NQTs fall back on the easiest method, almost always a word based method and some revert to the models in which they recall being taught to read in as primary pupils themselves. As NQTs they are not well versed in reading pedagogies appropriate for large classes of young children and so decoding of words taught through oral repetition and choral whole class becomes the dominant pedagogy which sometimes prevent rather than support pupils to learn to read. The comprehension of words and of longer connected text can be divorced from decoding and do not have the same knowledge base. The implications of teaching reading to pupils who do not have a grounding in the target language had not been emphasized in training and was not evident in teaching. Some NQTs were able to adapt to the classroom environment more easily than others, especially when they were paired with another NQT as in Ghana, or were able to learn from colleagues or informal in-school CPD as in Uganda and Tanzania, producing reading materials and using them effectively. Few NQTs received expert induction or mentoring by experienced teachers in a systematic manner.

Chapter 4 Learning to Teach Early Primary Mathematics: the contribution of initial teacher education

This chapter draws together insights from the six country reports on how prospective teachers acquire their knowledge and understanding of teaching early grade mathematics (grades 1-3), and how initial teacher education contributes to this. Drawing from both quantitative and qualitative data it presents evidence on the factors which shape teacher educators, trainees and newly qualified teachers understanding of learning to teach early grade mathematics, and the gaps between their knowledge and understanding of practice. The chapter also provides a profile of topical areas that NQTs find more or less difficult or easy to teach and what that signals about the efficacy of the pathways in learning to teach.

4.1 What do Teachers need to Know and able to do to Teach Primary Mathematics?

Before mapping out what teacher educators, teacher trainees and newly qualified teachers across the six countries know and understand about teaching primary mathematics, it is important to summarise what the international literature says about what teachers should know and be able to do to teach the subject. Generally, the research on mathematics teacher preparation for lower/elementary teaching suggests that, teachers' knowledge of mathematics, how it should be represented in teaching, and their knowledge of pedagogical procedures, are important in influencing how their students learn mathematics (Fennema & Franke, 1998). It is also recognised that the extent of trainees' exposure to and understanding of curricular materials, including textbooks makes a difference in their ability to teach school mathematics effectively (Ma 1999).

4.1.1 Mathematics knowledge

Many teacher education programs are designed on the assumption that a strong mathematics knowledge base is a key to learning to teach the subject effectively (Ball, 1990, 2000). We see this demonstrated in the time often allocated to studying mathematics content in ITE programmes in Africa where it is justified because many trainees enter with weak qualifying grades in the subject (see Akyeampong, 2003; Lewin & Stuart 2003).

In Kenya, for example, the African Population and Health Research Centre (APHRC) produced research on primary school teachers' mathematics subject knowledge which showed them scoring poorly in the mathematics they teach. On that evidence it was recommended that ITE should strengthen the focus on teachers' mathematics knowledge (APHRC, 2010). However, research on teaching shows that teachers' ability to represent and formulate mathematical concepts and processes in ways that help learners understand mathematics is of greater importance than simply spending time updating their mathematics knowledge. Mathematics knowledge is important in as far as it enables teachers to develop deep conceptual and structural understanding such that they can represent it meaningfully. As Ball (2000) points out, simply "knowing that subtraction is a particularly difficult idea for students to master is not something that can be seen from knowing 'big ideas' of the discipline (p 245). Furthermore, Hill and Ball (2004) stress that "*how* teachers hold knowledge may matter much more than *how much* knowledge they hold (p 330). Similarly, knowing the subject matter knowledge that their students are to learn has limits in terms of teachers' capacities to teach the subject with meaning. What is important is how teachers represent school subject knowledge in ways that help students to develop robust understanding. Ball (2000) contends that to achieve this, we must start with practice and understand the work that teachers do, analysing the role played by mathematics knowledge in that work. Although a teacher may be able to do mathematics, he/she may not have the kind of mathematical understandings that can help students learn it meaningfully (Ball 2000). Ma's (1999) research exploring Chinese and U.S. teachers' mathematics knowledge revealed that the former had better capacity to explain elementary mathematics because they had studied teaching materials intensively and understood more deeply their own pupils' learning of the subject.

The approach of many ITE curricula on learning to teach mathematics in Africa tends to be one-dimensional – beginning with an emphasis on subject knowledge leading to pedagogical content knowledge as the knowledge base for practice (Stuart & Lewin 2002; Stuart, Akyeampong & Croft 2009).

What research on teaching and teacher education suggests is that, teachers' knowledge of mathematics and the training they receive plays an important part in how they perceive and rationalise their competence in teaching (Ball, 1990; Hill & Ball, 2004). If we are to understand why many African children in lower primary fail to grasp basic knowledge of mathematics, then it is important to investigate what happens in learning to teach the subject, and how that learning shapes what prospective teachers know and do when they start teaching. Beginning to understand this is a necessary precursor to improving primary teachers' effectiveness in teaching mathematics for understanding.

4.2 Tutors and the teaching of early mathematics

4.2.1 What preparation do tutors receive to teach in ITE?

Significantly, all the mathematics tutors in the colleges had no special training for teaching primary mathematics at ITE level. Many recollected challenges in teaching the subject for the first time in college and confessed to a lack of intimate knowledge of the primary school curriculum. References to primary mathematics were restricted to knowledge of the topics in the syllabus. With little or no prior training to teach primary ITE mathematics, and virtually no induction, mathematics tutors relied on two main sources of knowledge to inform their practice.

The first of these was fellow tutors who shared tips and experiences on how to teach methods for primary mathematics – in Tanzania for example, mathematics tutors often replicated what other colleagues were doing and therefore had no systematic and organized introduction in how to teach primary mathematics. Some drew on their own earlier experience of teaching in primary schools. In Kenya, tutors relied much more on experienced colleagues for guidance but preferred a more discursive and reflective process of learning to teach. The area where they sought assistance was in how to teach primary mathematics topics using a variety of teaching and learning aids (TLMs). In Mali they even talked of speaking to retired teachers.

The second source of knowledge was ITE mathematics textbooks, books on methods of teaching primary mathematics, and tutor prepared hand-outs/pamphlets (e.g. Ghana, Kenya, and Tanzania). In Kenya and Tanzania tutors complained that college textbooks were old editions and, therefore, did not reflect recent ideas of teaching primary mathematics topics.

Evidence from observations of mathematics lessons in the colleges showed that the methods of teaching primary school mathematics topics placed emphasis on sequencing, the use of concrete apparatus, and tutor or trainee demonstration of prescribed methods. In Ghana and Tanzania, for example, although tutors seemed aware of the importance of studying primary school curriculum materials, these did not feature as part of their repertoire of teaching activities. In Ghana, tutors referred to knowledge of school curriculum materials as essential in training, but did not incorporate them into their own practice. Tutors in Tanzania complained about not participating in curriculum reviews and development of both ITE and primary mathematics curriculum, and as a result not intimately aware of the requirements. In both Mali and Senegal, studying the primary mathematics textbook was also not a part of the ITE curriculum and tutors were not familiar with the current materials. In general, tutors were unable to provide strong and clear rationales for the organisation of the primary mathematics curriculum, partly because it did not feature as part of instructional practice in the colleges.

The importance of studying the interrelationship between the structure and content and basic concepts in lower primary mathematics was rarely a part of tutors' discourse on learning to teach primary mathematics. Instead much of the focus was on how instructional materials could be used to teach basic mathematical concepts, although this was at a superficial level. Clearly the lack of formal training for tutors meant that their knowledge and understanding

of how to teach lower primary mathematics was often patchy and uncoordinated. Tutors seemed comfortable following ITE prescribed methods of teaching basic mathematics concepts and were not critical about applicability in real classroom contexts.

4.2.2 Tutors' Instructional Practice

Tutors' instructional practice very much reflected their own understanding of what it meant to teach primary school mathematics. Generally, ITE lessons focused on demonstrating the use of concrete apparatus as an essential tool for developing conceptual understanding. Often these were used uncritically.

In Ghana, tutors generally used the lecture method interspersed with demonstrations showing how to use TLMs to develop basic mathematics concepts. Trainees rarely demonstrated the use of TLMs in teaching. Classroom interaction was organised around tutors posing questions and waiting for responses from trainees. There was very little discussion on how, for example, mathematical knowledge and concepts could be represented in different forms and contexts to enrich children's learning and understanding. In Kenya, tutor lessons were often characterised by tutor and trainee demonstrations of the use of TLMs to teach concepts e.g. place value and addition of two/three digit numbers. However, the use of TLMs was rarely critiqued in terms of how they might work in real classrooms. Evidence from NQT classroom observations shows a deep gulf between knowing or understanding the methods and applying them effectively to promote meaningful learning for pupils. For example, in one lesson on teaching place value although the tutor demonstrated the use of a variety of TLMs e.g. bundles of sticks, counters, place value tins, number line and the abacus, the differences these materials conveyed in terms of difficulty and understanding of place value was not explored or discussed. Instead, the materials were presented as methods for teaching place value in the addition of two or three digit numbers without distinctions in meaning in relation to the structure of the materials. In some lessons observed in Senegal pupils were given TLMs to play with as an introduction to a mathematics lesson but these were then put aside when the task of solving problems began.

Tutors in Uganda often started their lessons by asking trainees what they knew about the topic, and then supplemented the trainees' knowledge with their own contribution, followed by leading the whole class through illustrations with a few examples before having them work out some problems individually. In Tanzania, tutors tended to follow a standard approach to teaching: demonstration, practice, teacher assessment and home assignment. Demonstration lessons showed practically how a particular method was to be used in teaching a concept based on recommendations in the ITE mathematics syllabus.

Across the countries tutors spent considerable time teaching about how to use TLMs in primary mathematics lessons. In Kenya some tutors were not convinced that primary school teachers used as much of these materials in their classroom practice. This was attributed to either pressure of work as teachers try to cover the syllabus in a highly competitive examination oriented environment or to sheer negligence. One tutor explained that older teachers would often mock NQTs for using TLMs by saying things like, *'you will draw those charts and you will get tired of drawing'*, and telling NQTs that the charts will not improve students' mean grade³. Another tutor estimated that NQTs give up using TLMs within a year of their starting to teach. This knowledge of practice in the Kenyan context was not viewed as an opportunity to analyse the sort of challenges teachers might face in applying methods learnt in college, and how TLMs could be made more accessible and user-friendly to increase its use in classroom teaching. As the Kenya report notes: "our conjecture is that although TLMs are in principle valued, their use has become so ritualised to the point where how they communicate conceptual understanding is lost, and coupled with the general constraints on teaching (e.g. examinations pressure, over-loaded syllabus) undervalued in practice".

Generally, tutors' approaches were didactic and highly prescriptive, but they were aware of the importance of linking the college ITE curriculum to the primary mathematics curriculum. There was surprisingly very little said about how the teaching approaches/methods being prescribed might come across to primary pupils. Basically college tutors saw

³ This is the average score for the school or class in an examination

their role as introducing trainees to laid-down methods of teaching primary mathematics and left the business of translating this into practice to trainees at a later time when they begin teaching in schools. Learning to teach mathematics was not presented as a process in which pupils' perspectives and understandings, and classroom environments were problematized and critically examined in the light of the topics in the school mathematics curriculum. This was very far removed from the contextualized, problem-solving approaches of the competence-based and thematic school curricula.

4.3 Trainees Knowledge and Understanding of Teaching Primary Mathematics

Across the 6 countries, colleges placed great emphasis on studying more advanced topics in mathematics. The idea that trainees needed to update or upgrade their subject content knowledge as part of their preparation to teach even at the primary education level is not new (see MUSTER studies – Lewin & Stuart, 2003). The emphasis though in the research was to explore what trainees saw as the value of the training in terms of preparation to teach lower primary.

Trainees tended to view ability to teach well in terms of applying procedures or methods acquired in training:

I can say I have learnt a lot. I am now able to go to class and teach properly. Before I joined this place, I thought people just go to class and teach so long as you know how to calculate math, you can calculate what the pupils can understand. But now I know the procedure (Kenya Trainee)

In Senegal, for example, trainees are trained in planning and implementing a lesson. They also receive training in mental calculation, counting, geometry, measurement and calculation practice. Tutors teach them to master the steps of the math lesson focusing on the movement from concrete via the schematic to the abstract⁴ – an approach which is quite similar in the other countries. Not surprisingly, the sense that they have now acquired 'tools for teaching' fills them with great optimism. As one Kenya trainee explained:

I am now glad that I know the stages to follow when teaching contents in maths. I now understand how the various steps of the lesson structure should follow from the start to the end (Kenya Trainee)

Trainees in Senegal explained their optimism in terms of personal qualities and motivation, and from the fact that they had gained knowledge on strategies for teaching mathematics. But in Ghana, trainees were quite aware that translating acquired knowledge and skills into practice would not be easy because of attitudes of teachers with some experience of teaching:

Our seniors [more experienced teachers] in the field always give us the idea that what we learn here [in college] might not be relevant and for that matter we should just learn the methods to pass our teaching practice; and after that we do our thing as those on the field (Ghana Trainee)

In principle, most trainees understand the need to use concrete materials and examples to develop conceptual understanding. When asked, what was the best way to help children understand basic maths concepts, the majority opted for using concrete and practical examples in teaching, which is consistent with the kind of emphasis that college tutors placed through their practice on using concrete objects to illustrate basic mathematical concepts (see table 4.1).

Trainees in Uganda reiterated the importance of manipulating concrete objects in developing conceptual understanding, although this was seen first and foremost, as part of a teaching sequence and not the main activity in which pupils are in control.

⁴ For example –concrete: manipulation of sticks and bundles of sticks (units and tens); schematic: using drawings showing sticks and bundles; abstract: doing sums with written mathematical notation.

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When teaching mathematics ... say addition ... teachers should demonstrate a skill to pupils and ensure that they follow his demonstration ... for example, pupils should repeat numbers after the teacher has said them out loud. He can call a few of them to do the same after him and before the class. Then all pupils can be given room to practice addition using their stones ... and write answers in their exercise books ... at the end pupils should be given a take home assignment for them to practice at home (Uganda Trainee)

Table: 4.1: The best way to help children understand basic concepts in mathematics is to:

		Trainees (% by question and country)					
		Ghana	Kenya	Mali	Senegal	Tanzania	Uganda
Show them lots of worked examples	Strongly Agree	47.38	23.33	33.94	10.18	46.11	29.98
	Agree	38.63	39.82	33.58	22.4	39.74	37.32
	Disagree	10.17	23.17	19.89	35.33	10.73	20.34
	Strongly Disagree	3.82	13.68	12.59	32.1	3.42	12.37
Teach them to remember important steps	Strongly Agree	36.45	45.84	35.86	21.32	59.55	37.98
	Agree	49.76	42.94	45.47	52.46	34.32	45.06
	Disagree	11.57	7.75	13.49	19.4	4.72	13.73
	Strongly Disagree	2.22	3.47	5.18	6.83	1.42	3.22
Give them lots of worked examples to practice	Strongly Agree	70.22	35.34	54.01	50.78	56.25	35.46
	Agree	27.23	37.7	39.05	40.84	35.73	47.77
	Disagree	1.75	18.32	4.56	5.75	5.66	13.16
	Strongly Disagree	0.8	8.63	2.37	2.63	2.36	3.61
Use concrete and practical examples to teach	Strongly Agree	93.18	87.96	66.24	73.05	85.61	90.18
	Agree	5.43	10.24	31.4	25.51	13.44	7.36
	Disagree	0.16	0.78	1.81	0.84	0.83	1.23
	Strongly Disagree	1.24	1.02	0.54	0.6	0.12	1.23

The problem with this is that teachers will never know whether conceptual understanding has been developed, but only infer this because pupils can repeat the actions or activities. The findings from classroom observations, particularly in Ghana, Kenya, Senegal and Mali show that although trainees appreciate the value of concrete activities in learning maths, translating these into practice in a way which communicates adequately the concept from the learners' perspective can be challenging. Often teachers move quickly from concrete to the abstract.

Trainees from across the six countries seem to think that 'teaching steps in mathematics' is necessary for conceptual understanding (table 4.1- strongly agree and agree) – it reveals the superficial nature of their understanding of how conceptual understanding develops, and reflects the emphasis that tutors in general placed on 'steps' and 'procedures' in math lessons. None of the country studies reported occasions where trainees discussed the conditions under which children could gain control of concept development in learning basic maths. Instead, the emphasis is always on how trainees gain control of the concepts using concrete objects. Our data suggest that the difference between these two understandings is not fully appreciated by tutors, trainees and newly qualified teachers.

The opportunity to study intensely the primary mathematics syllabus and textbooks at ITE level was lacking in all the case study countries. In Kenya, tutors felt that once trainees had acquired the knowledge and skills for teaching primary mathematics their job was done, and it was up to trainees to apply them to the school mathematics

curriculum requirements. For trainees in Ghana, their first and real encounter with school curriculum materials occurs during teaching practice, and even then for lower primary the exposure can be very short.

We don't normally get well acquainted with the syllabus because you only teach in lower primary once [i.e. during teaching practice]. In the three weeks [of teaching practice], you are given specific topics to teach and you concentrate only on these topics so you are not able to look at other things (Ghana Trainee)

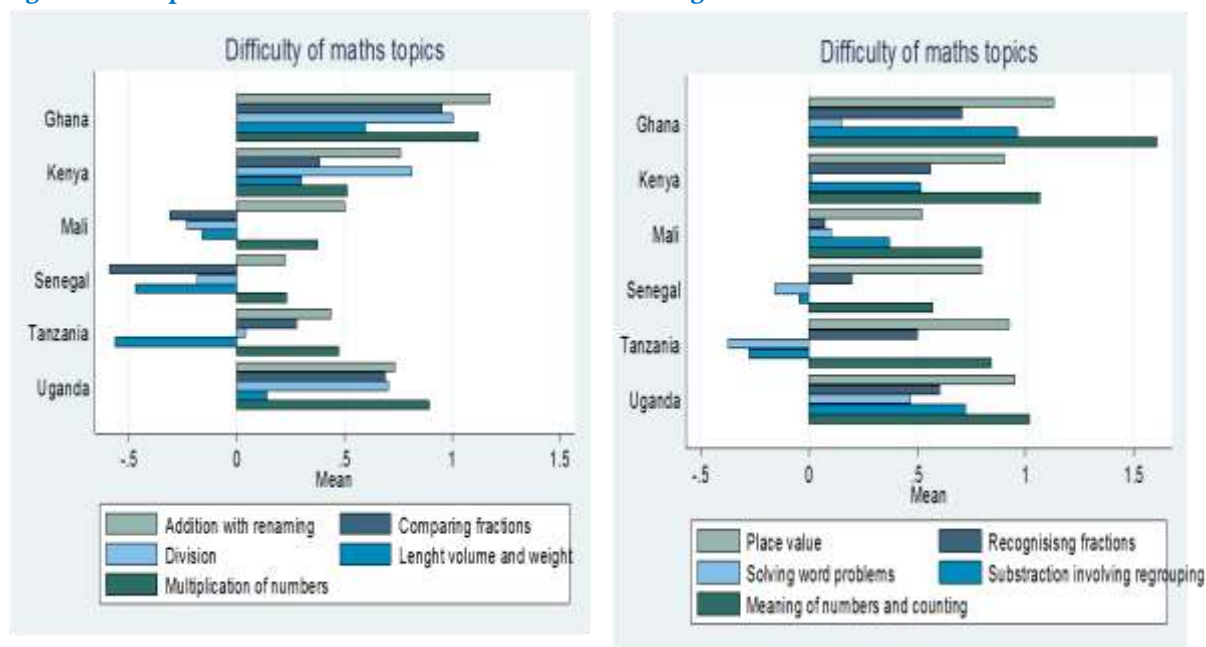
The trainee accounts of their ITE experiences in relation to learning to teach basic mathematics across the six countries suggest that many will be entering the teaching field with a superficial understanding of what teaching for conceptual understanding in mathematics means. There is a strong sense that this means: (1) manipulating concrete objects to illustrate the conceptual idea, (2) ensuring that prescribed steps are followed by teacher and pupils, (3) reinforcing the concept through practice and drill. Although these are all important, what trainees are missing is the: (1) opportunity to interrogate what they are learning through practice and critical reflection, (2) intense study of school mathematics textbooks and syllabuses and the use of investigations to develop basic mathematics concepts (see Ma 1999).

4.3 School Mathematics Topics trainees and teachers (NQTs) find difficult to teach

Understanding which basic mathematics topics trainees and NQTs find difficult to teach should give an indication of the areas that their own conceptual understanding may be lacking. There were clear differences across the six countries. Trainees and teachers in Ghana and Kenya find primary math topics in general least difficult.

- Topics that trainees and teachers in Mali and Senegal find difficult: Geometry, Comparing fractions; Division; Length, Volume and Weight
- Topics that trainees and teachers in Senegal alone find difficult: Solving word problems; subtraction with regrouping
- Topics that trainees and teachers in Tanzania alone find difficult: Length, Volume & Weight; Solving word problems; and Subtraction with regrouping.

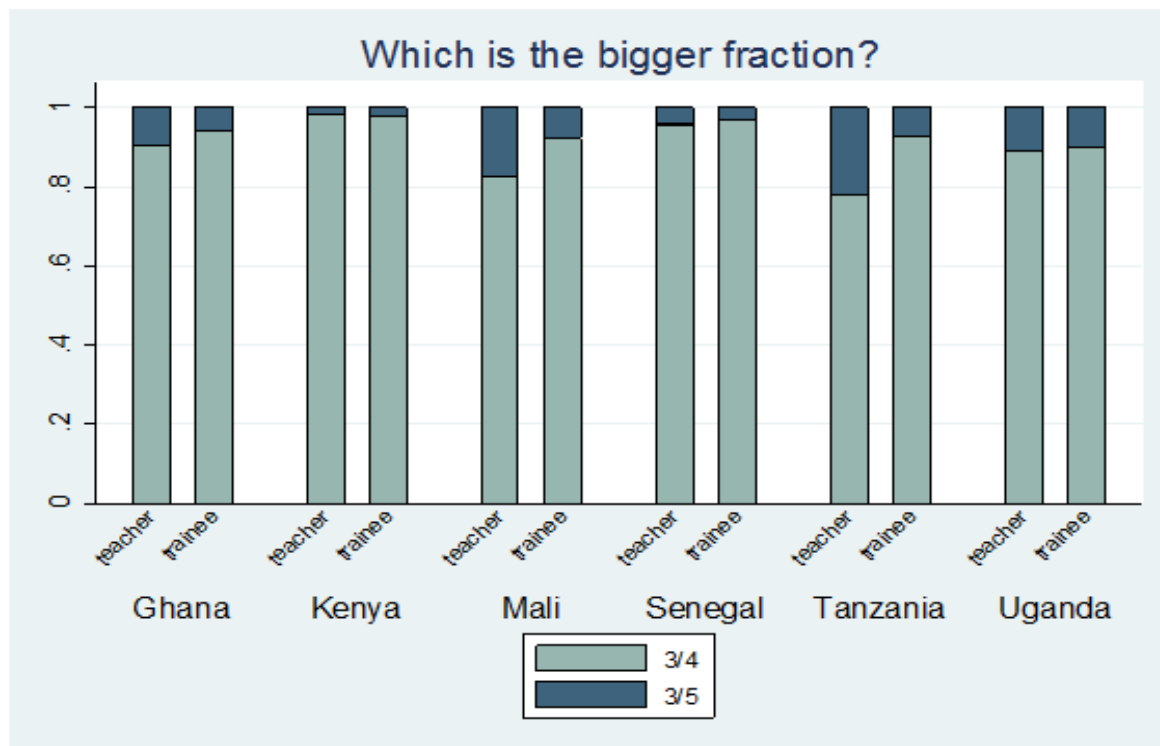
Figure 4.3: Topics trainees/teachers found difficult teaching



The majority of NQTs observed in Senegal cited problem solving as among the most difficult area to teach and gave two main reasons why this was so – first, because they had not received specific training in teaching problem-solving; and second because of non-mastery of texts written in French which makes it difficult for students to understand what the problems required. One NQT, however, explained that by switching to real-world problems, as advocated by the school curriculum, where pupils formulated the problems using their own words, they could easily solve simple word problems in basic mathematics. Clearly, in this approach pupils were engaged in problem-solving from their own perspective and experience – this was an exceptional example, but shows what can be achieved if learning mathematics becomes learner-centre focused.

The topics that trainees and teachers in all the countries found easy to teach, although to varying degrees, were: place value; meaning of numbers and counting. The research found that a disproportionate amount of teaching time in the classroom observations were spent teaching ‘place value, addition and number concepts’. Many college tutor lessons on how to teach lower primary math focused on these topics. In fact, counting and number work was rated as relatively easy to teach compared to the other topics. Solving mathematical word problems was also considered relatively difficult to teach. We suspect that these may be topics that are not given much attention at ITE level in terms of teaching time and the use of concrete materials and practical illustrations to develop their underlying concepts. More attention may need to be given to how these ‘difficult’ topics can be made easier to understand conceptually through concrete activities/materials linked to everyday contexts in which these mathematical concepts apply or occur.

Figure 4.4: Comparing two simple fractions – $\frac{3}{4}$ and $\frac{3}{5}$



An item in the survey asked trainees and NQTs to select which of the fractions $\frac{3}{4}$ or $\frac{3}{5}$ was the bigger fraction. Although the majority got it right (about 90%), quite a significantly small number selected the wrong fraction ($\frac{3}{5}$) (figure 4.4). What was even more revealing is that many of the explanations given by those who got the right answer focused on formulaic technically worded explanations e.g. expressed in terms of lowest common denominator. The

explanations, if used to help young learners understand the difference between the two would be quite likely unproductive. It goes to show that both trainees and NQTs lack deep conceptual understanding of basic mathematics concepts such as the fraction concept.

4.4 Linking Knowledge, Understanding and Practice – Insights from NQTs

The research explored from NQT perspectives where they believed their best understanding of teaching primary mathematics emanated from. Partly this was to see how much of ITE is considered influential in their practice. The results are quite revealing and reflect in part the opportunities and challenges confronting beginning teachers in the early years of teaching in primary schools (table 4.2).

Table 4.2: Where would you say you developed your *best understanding* of teaching primary school mathematics?

	Ghana	Kenya	Mali	Senegal %	Tanzania	Uganda	All
In-service training	1.29	7.24	14.77	17.22	18.72	8.62	12.49
Other teachers	5.81	3.95	7.08	25.56	8.02	1.72	9.46
Training College	84.52	63.16	30.77	25.00	50.80	67.24	47.87
Work in Schools	8.39	25.66	12.62	22.22	22.46	22.41	17.79
Sample size	155	152	325	180	187	58	1057

The following are conclusions from these data:

- A striking observation is that other teachers' practice has registered the least influence on NQT practice across all six countries. On average this is about 9%. This reflects the lack of induction and systematic mentoring for beginning teachers in all the countries.
- Teachers in the two Francophone countries (Mali and Senegal) experience a wider range of influence on their practice than the Anglophone countries (Ghana, Kenya, Uganda & Tanzania)
- NQTs in Ghana see ITE as having the greatest influence on their practice. Surprisingly only about 8% think working in schools has influenced their teaching of basic mathematics. The ITE programme in Ghana like that in the colleges in Mali, has a final year (the 'out' year) of block teaching practice where trainees spend approximately a year in schools learning to teach. It appears that this extended period makes very little difference to their practice. A plausible explanation is that the curriculum of the 'out' programme is not designed to focus attention on experimentation and critical reflection of practice, and therefore, trainees during this stage do not see this as the purpose.
- The influence of ITE in the case of Kenya is still high (63%), but also about a quarter of NQT believe work in schools has had an influence on their teaching of basic mathematics. Although this is a relatively small number, it is significant in the sense that, unlike the other countries, NQTs in Kenya have had longer periods teaching often in private schools.
- In Mali, in-service training (15%) and ITE (31%) exert the greatest influence on NQT's teaching of basic mathematics. Also, about 13% felt that 'work in school' was influential. Although trainees spend a very short amount of time learning mathematics teaching methods during training they may count the final year of block practice as part of ITE.
- Senegal has the widest range of influence on NQTs understanding of teaching basic mathematics. ITE training is reported to have the least influence on their understanding (25%). Senegalese teachers often

cited the lack of practice during initial training as hampering their ability to teach some mathematics topics effectively. Senegal is also the only country where the influence of 'other teachers' in developing understanding of teaching primary school mathematics is high compared to the other countries (about 26% compared to the overall average of 9%). This is likely to be influenced by the fact that teachers in Senegal take part in school based in service teaching where they discuss their work with colleagues.

- Teachers in Tanzania and Uganda reported that similar levels of influence from 'work in schools' (about 22%). Also in Tanzania in-service training shows a relatively strong influence (about 18%) compared to Uganda (about 9%).
- Overall, across the 6 countries, the influence of ITE in developing the best understanding of teaching primary mathematics is about 50%. Following after that is work in schools (18%), and in-service training i.e. CPD (12%)

4.5 NQT Practice in the teaching of lower primary mathematics

Across the six countries there were common features of NQT practice which reflected the inadequacies of the ITE programmes especially in how they were divorced from the realities of classroom practice. Also, what emerges from the classroom observations and interviews is the problem highlighted in the ITE data about the lack of exposure to school curriculum materials as part of developing understanding of how to teach basic mathematics. Teaching learning materials (TLMs) dominate, and in each country, NQTs struggle with making what is prized at ITE level an effective part of promoting understanding.

Ghana

NQTs taught a wide range of primary topics, but focused a lot more on *subtraction, addition, multiplication and division of numbers*. A few taught measurement of time and fractions. Many were able to mention more than one method of teaching a concept even though in practice they usually demonstrated one method. One teacher, in a peri-urban area for instance, used comparison (one-to-one matching) to introduce subtraction of numbers. Although he did not introduce other approaches to develop the concept, he described another approach that might have been used: "missing addend approach". Others mentioned "take away" and "comparison" methods. In practice, the teachers did not demonstrate the different approaches and seemed to use one they were comfortable with. A grade 3 teacher for instance, taught addition of numbers using the abacus method as a demonstration and immediately moved to a symbolic representation of the concept.

What NQT lessons did not reveal were variations in the application of methods/TLMs to different problems to illuminate concepts and deepen understanding. Not one teacher observed made the attempt, for example, to use a TLM or method to correct pupil errors or understandings. Once the TLM had been used in a demonstration, it had served its purpose and was abandoned for the rest of the lesson. NQTs felt that timetable constraints prevented extensive use of TLMs in teaching.

NQTs frequently code switched (i.e. move between using English and the local language) and on no occasion was a local language or English used entirely in teaching. Code switching was considered necessary to "*help [pupils] to understand what is going on*" Another teacher explained that he resorted to code switching in "*in the situation where you teach and [pupils] don't understand you just translate it to the Twi [the local language]*". They admitted that the issue of code switching in teaching mathematics to develop conceptual understanding is not a subject of study in ITE and yet is commonly practised in teaching at lower primary level.

Basically, all the NQTs teaching could be described as following three sequential steps: (a) an introduction, (b) the main presentation led by the teacher, and (c) a conclusion which involved giving pupils similar exercises to perform in

their exercise books. The few times where pupils actually handled an instructional material was merely to repeat what a teacher had demonstrated.

When we were solving the one on four and two on four [developing concept of fraction] I gave them the materials and then I took part. I folded it [a piece of paper], for the first one I folded it into four portions and I asked them to fold it as I have done and then the second one I folded it into four. (NQT Ghana)

In this case no attempt was made to use the manipulative to show the relationship between the pupils' knowledge and the new knowledge that was being introduced. The manipulative was not being used to pose or solve problems in ways that test understanding.

From the lesson observations and interviews with all thirty-four NQTs, the research identified a predominant model of teaching which fits what one might call a 'classroom-focused view of teaching', described by Thompson (1998). Thompson adds, "accordingly, the students' role is to listen attentively to the teacher and cooperate by following directions, answer questions, and completing tasks assigned by the teacher" (p. 137). This model of teaching characterised NQTs' teaching of primary mathematics, which in effect shifts teaching from an emphasis on developing deep conceptual understanding through pupils' personal construction of mathematical knowledge. This approach to teaching is strongly influenced by what teachers learn in the colleges, and confirms MUSTER analysis of TTC curriculum delivery in Ghana which "... stressed prescriptive teacher behaviours, rather than critical reflection and personal agency in teaching (Akyeampong & Lewin 2002, p. 347).

Kenya

NQTs mathematics lessons were highly structured comprising an introduction reviewing the previous lesson and a number of activities in which individual students or the whole class engaged were involved. Usually there was a demonstration by the teacher using a TLM to teach a concept. TLMs used included counters such as pebbles, seeds and bottle tops, sticks, a clock and teacher and student-made beam balances. This was followed by students working on assigned exercises individually with the teacher circulating to check on progress.

Generally, NQTs applied a highly structured approach to teaching mathematics and believed that this was ultimately the key to helping students learn the subject with meaning. What was not evident in the lessons was a certain responsibility to subject matter which unpacked students understanding and responded with appropriate action. Although strenuous efforts were made to engage students through activities which usually involved either the teacher or students manipulating a TLM, this tended to be highly didactic. When teachers were asked to explain what it was about their lesson that they felt promoted understanding, they would often refer to the systematisation of lesson delivery: *"the systematic steps are very useful ... because they help the children to retain much what you have taught; when you take them through those steps at least they can remain with something concrete in their minds"*. Both teacher educators and trainees reiterated TLMs facilitated better learning - enabling the teacher present concepts in a comprehensible form:

In maths, it becomes very easy for the pupils when we use teaching aids such as counters in addition and subtraction, a 'shop' while teaching about money, and also if it is measurements in standard two and three the use of measuring sticks. So these materials help the children to understand. If we teach orally without using the materials, they tend to forget (NQT Kenya)

NQTs reinforced the notion that linking mathematical concepts to concrete materials aids understanding but were unable to explain satisfactorily how the TLM had aided understanding. Their explanations were rule bound. Contrary to their explanations, many NQTs were not using the TLMs in a manner that steered towards developing deep conceptual understanding. For example, in lessons where teachers taught place value in addition, although teachers offered students the use of counters, some would quickly do the sums mentally and give the correct answers, totally ignoring the counters and what they were meant to demonstrate. Others simply counted but seem not to make the connection between the manipulative and the concept. Also asked how they would help weaker students, NQTs often said they would simply repeat aspects of the lesson. The talk was not about how they might,

say, vary the approach or diagnose the difficulties and respond appropriately by either adapting or changing their method. The common practice was for students to follow teachers' instructions by repeating actions even in so-called activity-based lessons. When researchers probed for NQTs' sources of teaching knowledge other than that gained through ITE, few made references to knowledge gained from experienced teachers or through reflective practice.

Tanzania

The research found that a common practice in teaching mathematics for lower grades is drilling and cramming, in particular the drilling of multiplication tables 1 to 12 in grade 3. In another example of standard practice a teacher teaching multiplication to standard two students asked pupils to put their counting objects on desks and look at her as she started presenting a new lesson by showing one example of multiplying 2×3 . She drew three groups of two oranges each on the chalkboard and let students count them to get the total. Later she explained to the pupils that 2×3 means you take three groups of 2 objects and you add them up. She gave a second example where she asked them to use their counting objects (sticks) and arrange three groups of two sticks each and then combine them and count the total. She called a few pupils, one at a time to demonstrate the same activities. After three to four examples the teacher wrote an exercise on the chalkboard for pupils to practice individually and write answers in their exercise books. Students were guided to multiply using their counting sticks and write the answers in their exercise books. The teacher passed around checking their progress and marked their books as well. She finished by collecting for marking the exercise books of pupils who did not finish on time. This structure of teaching was quite common among the NQTs. Although many pupils repeated the activities successfully, there was no way the teacher could actually know that the underlying concept had been grasped because of the likelihood that pupils were simply repeating with deep understanding, what the teacher had demonstrated.

A slight variation of this practice was one where the teacher directly involved pupils in the mathematical manipulation with full integration of teaching learning aids, rather than demonstrating while pupils passively looked on. In this case, progression and challenge for pupils was embedded within the pedagogy. An example of how NQTs mixed concrete and abstract approaches creating confusion in learning was in a lesson about fractions. The teacher spent much time carefully drawing circles on the board at the beginning of the lesson. She then taught halves and quarters by asking pupils to shade in half of a circle, then organised pupil groups of 6-8 who watched a peer cut an orange into halves and quarters. One child sliced the orange rather than cut it into fractions. Individual pupils came to the front and verbally rehearsed what they had done to the fruit. In the written exercises which followed, the teacher divided shapes into three and shaded one part thus silently introducing the concept of a third without having developed this in the lesson. Rather than consolidating and assessing their existing understanding through the group exercise, the teacher introduced a new concept of a third without having taught it.

This example illustrates that though NQTs might have acquired approaches in teaching, one challenge is how they can organise what they know into meaningful learning experiences for pupils. It is another example of the use of TLMs as simply a starting step without critical engagement to promote deep understanding.

Uganda

Mathematics lessons observed had more or less a similar lesson structure as in the other countries but were very practical. Whether taught in English or local language, on addition, division, fractions, or multiplication, no less than three or four examples were worked by the teacher and the whole class on the chalk board, using tangible materials such as sticks or stones, before the pupils worked together in small groups using TLMs. Group work was however only a bridge to individual work done in pupils' exercise books and sometimes there were insufficient numbers of materials for all groups to engage in the exercise. A common explanation why often TLMs are not used extensively in teaching was that the crowded nature of the classrooms made such use impractical. The chalkboard was commonly used for illustrations, sometimes extensively to show examples. Some classrooms had corners with a number of items such as stones, bottle tops, drinking straws, empty packets and others which children used to solve

problems. But on the whole the research found that NQTs concentrated a lot more on the board with the teacher using concrete materials in her demonstration. A few used charts but there was no textbook used in any classroom.

Senegal

NQTs teaching approach in Senegal was often highly didactic. Some found the management of classroom learning activities particularly challenging, especially where children were using TLMs Mathematics lessons were planned to follow a predictable sequence as advocated in ITE: mental arithmetic, lesson development, chalkboard exercises and evaluation. Although some NQTs began their lessons with preparatory activities, sometimes these were not linked to the main lesson, raising questions about the purpose – as the Senegal report concluded: “many of the NQTs teach mechanically ... they have learnt an approach and implement it without deep understanding”. The different phases of the lesson were therefore not well connected and the connection between concrete and abstract although often repeated as important by NQTs was not made apparent to the pupils. Often time as problem and teachers were not able to get past the initial stages of the lesson. NQTs had difficulties finding practical examples to develop division, problem-solving and fraction concepts. As in the other countries, but perhaps more acutely, NQTs in Senegal used concrete objects in teaching in a mechanical manner which revealed that their pedagogical knowledge gained in ITE could not translate into structures for developing mathematical concepts. They struggled with how to generate representations using appropriate materials which might be an indication of their inadequate subject matter knowledge. Nevertheless some good practice was found and Senegal report did offer one example of an NQT giving a lesson around children’s own experience (playing marbles) in such a way that both captured their imagination and seemed to make a strong link with the concepts involved. This lesson was based on the guide to the competence-based curriculum

Mali

In Mali NQTs paid close attention to stages of developing a mathematical concept (from concrete to semi-concrete to abstract). However, in their lessons teachers spent less time engaging with the concrete in a way which could deepen conceptual understanding, and quickly moved to abstract representation of basic mathematics concepts. A significant number of lessons observed included no concrete experience at all and the research revealed that teachers particularly shunned concrete activities in numeracy lessons. As in Senegal, teachers were welded to following a teaching sequence and less tuned in to how pupils were developing deep understanding. Very little response to children’s’ work or diagnosis of children’s learning was observed. The lack of teaching and learning resources compounded the situation. But even when instructional materials were available, teachers did not use them appropriately or effectively or in a way that was well connected with the declared objectives of the lesson.

4.6 Conclusion: Gaps in Learning to Teach Lower Primary Mathematics

In this chapter research evidence presented and discussed focused on teacher educators, teacher trainees and NQTs knowledge and understandings of learning to teach basic mathematics in lower primary. The evidence presents us with serious questions about preparation for mathematics teaching in lower primary across the six countries. Although the underlying problem is common – poor ability to generate representations for mathematical concepts using concrete materials, the challenges and difficulties appear to have been more acute in Senegal and Mali, than in say, Kenya, Ghana, Uganda and Tanzania. There is general awareness that to develop conceptual understanding of some of the basic concepts in mathematics in lower primary real world (usually concrete materials) and practical examples are crucial.

However, as Ma (1999) points out:

Real world [concrete examples] cannot produce mathematical content... without a solid knowledge of what to represent, no matter how rich one’s knowledge of student’s lives, no matter how much one is motivated to connect mathematics with students’ lives, one still cannot produce a conceptually correct representation (p 82)

The following are key findings that illustrate the gaps in learning to teach mathematics in lower primary

- Tutors' knowledge and understanding of teaching early grade mathematics rarely reflects what teachers actually do in classrooms. The effect of this is that trainees develop very simplistic and unsophisticated understandings about teaching primary mathematics that underestimates the challenges and difficulties.
- Teaching and learning aids (TLMs) seen as central to developing conceptual understanding are presented ritualistically and unproblematically. Furthermore, there is no attempt to explore how TLMs contribute to substantive understanding of the concepts they are meant to represent. The research highlights the need to re-examine common assumptions about knowledge for teaching mathematics in lower primary and its implications for what should go into the ITE curriculum for learning to teach mathematics in all six countries.
- The research revealed rather narrow understanding of what it means to teach mathematics for understanding – teacher educators, trainees and NQTs discourse make little or no mention of the importance of exploring mathematical concepts such as place value, addition, fractions, from the perspective and understanding of children. The assumption appears to be that once prescribed teaching steps are followed faithfully, understanding will emerge – the how is seldom questioned. What seems lacking is an understanding of theory (teaching knowledge) as making sense of practice.
- Trainees and NQTs grow to associate teaching mathematics in the lower primary with unreflective conduct of activities using various TLMs. This may explain why with time some teachers abandon the use of TLMs in favor of traditional methods of teaching even as they continue to claim a learner-centered teaching approach (as in the example cited by Ghanaian trainees). NQTs had come to associate teaching mathematics in the lower primary with enactment of various activities with various TLMs without developing a deep understanding of the link between the activities enacted and the mathematical concepts being developed.

In reaching a decision about what should become a focus of ITE for training teachers to teach primary mathematics, it is important to ask the question: *what is it that teachers actually do and how does it produce or hinder deep understanding of mathematics concepts from the perspective of learners?* The research suggests that learning to teach mathematics for lower primary suffers from a mechanistic approach, not helped by the fact that teacher educators have had no formal training doing this job. As noted earlier, an understanding of theory (propositional knowledge) as how one makes sense of practice is totally missing in the philosophy and practice of learning to teaching in all six countries.

Unless there is a radical reconceptualization of ITE where the content of learning to teach primary mathematics is grounded in teachers' content preparation in practice, with "opportunities for learning the subject matter that would enable teachers not only to know but to use what they know in the varied contexts of practice" (Ball 2000 p 246), the experience of learning mathematics for children in these countries will be superficial and result in weak outcomes for trainees and pupils. Teacher Education curriculum developers should reflect on how teacher educators, trainees and beginning teachers can be supported to make connections between these materials and conceptual understanding. We argue that this must start with refocusing on the intense study of school curriculum materials and what it means to understand the subject from the perspective of children in the classrooms of each country.

Chapter 5: Continuing Professional Development

5.1 The place of CPD programs

The notion of continuing professional development as part of a 'continuum of teacher learning' has been evident in the research literature for some time (Craig, Kraft and du Plessis, 1998; Day, 1999; Villegas-Reimers, 2003; Schwille and Dembélé 2007). However, although it has now become part of the policy discourse for example in countries that have reduced the length of their initial training, it has remained, certainly in Sub Saharan Africa an analytic tool used by researchers rather than a description of a coherent framework that has been implemented. The purposes, types and modes of engagement of CPD have been categorized variously and those encountered by the TPA research fall into a wide range of categories. This chapter gives an overview of the CPD programs found in the study and analyses the benefits such CPD programs appear to offer for the teaching of early reading and mathematics. However, it has not been possible to make direct correlations between specific CPD programs attended in the last three years, their learning outcomes, content and teaching and learning strategies and any outcomes or changes in knowledge or practice of participating teachers. It was only possible to survey what CPD programs were available in each country on reading and to synthesis general points emerging from teachers interviewed, such as the Key Resource Teachers in Kenya. CPD programmes specifically dedicated to lower primary mathematics are generally rare – usually they will be part of wider CPD provision which is not focused on pedagogic content knowledge and practice in mathematics. This in itself is an important finding, as it indicates just how much more interest is on CPD for improving reading.

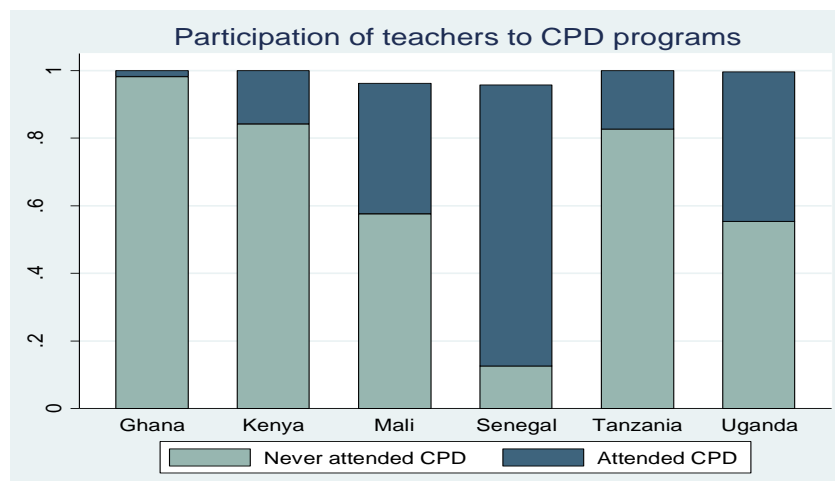
The timescale of the fieldwork for the research also constrained the sampling frame and the level of data that we were able to gain. In Tanzania some of teachers interviewed were experienced teachers, only some of whom it turned out had participated recently in CPD programs. Some teachers in Uganda had been on several short programs with reading or mathematics only a small component for example in the orientation to the Thematic Curriculum. A larger percentage of teachers in Senegal, however, taken part in CPD focused on mathematics as the fieldwork with NQTs was carried out in the areas where the major program was operating. Here as in Mali, cluster-based CPD is supposed to be compulsory, though a significant proportion claimed never to have attended. Experienced teachers' practice on the other hand will represent their training, professional development, other teachers and experience – an amalgam of practices difficult to disaggregate (Timperley, Wilson et al. 2007; Carlisle, Correnti et al. 2009). It has been possible therefore to draw together what more experienced teachers know and practice about the teaching of reading from East Africa and Ghana in particular, detailed in the final part of this chapter.

5.2 Incidence of CPD programmes

At any one time there appear to be many CPD programmes taking place in the six countries but they all remain small scale, are often one-offs and funded and directed by NGOs who sometimes have their own agendas for example on HIV or peace education. Specific programs on early reading were rare and on mathematics even more so. In addition, such programs reach low numbers of teachers in comparison with pre-service that reaches a critical mass of teachers. Unsurprisingly, therefore, only 16% of NQTs in the questionnaire considered that CPD had been more significant than these other three components.

Figure 5.1 shows that of the teachers included in our survey the majority had not received any CPD, though the figures for Ghana are skewed as the NQTs involved were those in the 'out' year of training and therefore not fully absorbed into the teaching force. The relatively high participation in CPD in Mali and Senegal is explained by the fact that in principle it is compulsory in those countries.

Figure 5.1 Participation of teachers in CPD programs



5.3 CPD in the six countries

Ghana

In Ghana there was no national CPD program focusing on mathematics and no regional one in the areas that TPA fieldwork took place.

In reading the most recent and nationwide CPD for teachers in is the on-going National Literacy Acceleration Programme (NALAP), a bilingual bi-literacy programme for early primary school which started in 2009/2010 aimed at helping pupils learn to read in a Ghanaian language while they learn to speak English. This is noteworthy as it marks a shift in emphasis in Ghana's language policy which since 2002 had been moving towards more emphasis of English. NALAP aims to introduce a different literacy curriculum where pupils are not expected to read English until grade 2. The programme lists milestones for literacy that pupils are expected to achieve in Ghanaian languages at each grade level and include the comprehensive set of reading skills of print concepts, phonological awareness, decoding and word analysis, vocabulary, fluency, comprehension and text selection. Importantly, teachers are given pre-supplied teaching and learning materials and are trained to use a Ghanaian language through group work and a literate environment. Reading is seen as a complex activity that needs decoding through a broad range of strategies involving both phonic and look and say methods. Comprehension of a variety of texts is encouraged with an active reader constructing their own knowledge and meanings of texts. The NALAP teachers used practices similar to that used by the NQTs and referred closely to the teacher's guide.

The NALAP teachers' literacy lessons observed were much longer than the norm, 90 minutes and followed the pattern prescribed by the program: first, oral activities; second, introduction of key words both orally and in written form; third, reading of the whole text in repeated chorus drills after the teacher or silently with very few teachers using the group and pair reading which the NALAP recommends; last, oral and written exercises of comprehension giving the opportunity to use the new vocabulary. In this it approaches reading from a perspective which is suitable for those learning a foreign language. Apart from its application to both English and a local language the research identified four big differences which brought NALAP teachers' practice closer to matching the practice as identified in research on reading:

1. Emphasis on oral activities and more time allotted to Ghanaian language reading
2. Conscious effort to develop identification and use of vocabulary
3. Combination of the 'look-and-say' and the phonic methods in one lesson.

However, some teachers could neither read nor write the target language they were expected to use in teaching reading and most felt that, 90 minutes was too long. Only two teachers out of 15 said they solely used the NALAP approach whilst the rest said they went back to what they had learnt in college or used their practical experience to guide their classroom actions.

Kenya

Teacher Advisory Centres (TACs) are well established in Kenya with TAC tutors appointed from experienced primary school teachers who organise and coordinating seminars, workshops and refresher courses for teachers on curriculum changes and pedagogy; and induct new teachers. However, the weight of management duties on the tutors, inadequate financial resources for training workshops and transport and inadequate training of the tutors themselves limit the overall effectiveness of this form of CPD.

The Ministry of Education has identified in-service education for primary teachers as a significant part of their investment program 2005-2010 (MOE, 2005) which has been spread across a number of programmes including Reading to Learn (RTL) and the School-based Teacher Development (SbTD). Overall although Kenya has an elaborate CPD infrastructure little has been done to institutionalise CPD of which the majority consists of small usually one shot projects by a variety of NGOs whose focus is usually dictated by the area of interest to the particular NGO. As a result there has been little CPD focus on key curriculum areas such as lower primary reading and mathematics.

The RTL intervention began in 2010 and focused on training lower primary teachers in reading and mathematics. The intervention is being implemented on a pilot basis in 64 schools in the educationally marginalized Kwale and Kinango districts of Coast Province by the Aga Khan Foundation in collaboration with the Ministry. It adopts the scaffolding approach and is based on an eight step procedure for teaching reading very similar to that seen in Senegal. It draws on a global approach to the text, moving to the sentence, the word and finally the sound. RTL teachers write the stories they use in class themselves. Therefore, a key focus of the training is on how to write the stories and how to use the stories in teaching. TAC tutors and RTL project workers provide professional support to the teachers in their schools. The RTL intervention is very new and so the African Population and Health Research Centre (APHRC) that has been contracted to conduct external evaluation has yet to provide evaluation information on the intervention. However, the teachers observed and interviewed were very enthusiastic about the approach and felt that it enabled them to help the children learn to read faster.

SbTD is the largest and longest running CPD program. Based on the reflective model of teacher education it has a cascade system of training at national, provincial, and district levels. Trained teachers are referred to as the Key Resource Teachers (KRTs) for their respective subject with one for each subject of English, mathematics and science per school and who were expected to train the other teachers in their schools. It aims generally at improving the quality of teaching. Across the project some of the best examples of practice seen in observations came from KRTs. Within a still teacher-led classroom they used a more problem-solving approach; for example they were more likely to use effective mixed ability group work, use time to enable children to practice reading and used library books. Lessons tended to move through content more quickly and kept all pupils engaged. For example one grade 3 KRT in Kenya was working with a class in which all except those recently admitted could read fluently and was able to explain how she ensured progression and bringing all pupils up to the mark. Another KRT was able to show how she was able to help children transfer knowledge from Kiswahili instruction into English medium lessons by making explicit connections in phonics instruction. Several KRTs observed used some code switching proficiently into and out of Kiswahili to teach reading and in our interview. One KRT was maintaining and using a school library effectively: *'We have a library and so they read. They finish one book and they come for another one. I tell them to tell me the story and they like that.'* The SbTD seems to have helped the KRTs but there was little evidence of their effect as trainers for their colleagues.

Mali

The notion of a 'continuum of teacher learning' is strongly recognized in policy in Mali and so is in principle a main pillar of the system. An important element of this is the *Communautés d'Apprentissage* (CA), or learning communities which are set at cluster or school level and supported by funds from Canadian International Development Agency (CIDA). However they do not offer a program of study so much as ask teachers to choose topics for development themselves, use supported self-learning in schools and sometimes are able to mobilize support from experts and inspectors. Our data suggested that participation was very patchy, depending on enthusiasm of head teachers and their staff. Support from the district education offices was often constrained by non-availability or unreliability of funds as was their own courses based on local perception of teachers' needs.

There were two main programs that the project looked at. PHARE (*Programme Harmonisé d'Appui au Renforcement de l'Education*) is a USAID initiative in Mali in association with the Ministry and running since 2008. The project overall is working in several different directions including beginning to offer CPD to college tutors. Its main thrust is on literacy where it is especially focusing on the balanced approach which is part of the primary national curriculum, yet is not well-known in Mali. The main way in which it involves primary school teachers is through offering a short introduction which is then followed up by daily radio broadcasts which are lessons in literacy for primary school children. The project provides radio cassette recorders and the recorded programs and live transmissions provide lessons for all the early years. Although the broadcasts are aimed at children when used in conjunction with the materials provided they also work as CPD for teachers involved. PHARE's approach is based on current research knowledge and teaching reading and also offers a much more interesting and varied range of activities for classes. In this way it seems to focus on the idea that in order to change teachers' thinking it is necessary first to change their practice (Elmore, 2002).

The other CPD programme focused on in Mali was the Training program to initiate the new competence based Curriculum. Aimed at all subjects including reading and mathematics, it is taking place throughout the country as schools change to new curriculum. Interviews with those who had taken part in it tended to focus more on the issue of teaching in a local language rather than on learning how to teach mathematics or reading through the competence-based method. The maximum of two weeks allocated to the training was not considered enough by teachers for them to get to grips with the new ideas.

The observation and interviewing in Mali did not show that the CPD programmes were having a great deal of effect. Teachers found it hard to apply what they have learnt from PHARE in other reading lessons and the lessons of those who had participated were not greatly different from those NQTs observed, who had not had any CPD. It should be noted though that the training in the curriculum is not just an introduction and will be repeated. The report suggested that the work of this program could be harmonised with that of the CAs.

Senegal

Senegal also has a cluster-based CPD programme called the *Cellules d'Animation Pédagogique* (CAP). Similar to the CA in Mali our data suggest that the attendance at these fortnightly sessions is not consistent. The project engaged with three CPD programs: PREMST⁵, supported by the Japanese International Cooperation Agency opening (JICA) and focused on mathematics and science in primary schools; SARENA⁶ which is concerned with reading; and the training on the introduction of the new competence based curriculum for basic education (CEB.)

PREMST was the program with the greatest number of participants in the projects' sample. It works through the CAP system with cluster-based training sessions which are supposed to be followed up by participants in schools. At the beginning of 2010 it introduced training for school principals so that teachers could get better support in schools. The approach is based on well-established classroom practices which JICA have been implementing in other countries,

⁵ Project de Renforcement de l'Enseignement des Mathématiques, des Sciences et de la Technologie

⁶ . Stratégies Actives pour la Réussite d'une École Novatrice en Afrique,

and includes a focus on active learning making and using TLMs with teachers discussion being an important part of the training. PREMST was very well received by the teachers who had taken part in it and there was evidence of it encouraging more concrete experience, partly because teachers were more confident in organising this kind of activity. However, teachers seem to see it as providing good ideas which they could graft onto current practices rather than enabling them to reframe their teaching with greater focus on pupil learning.

Although the fieldwork was conducted in places where SARENA was operating, the project found very few teachers who have taken part in it and district officers confirmed that the spread had been less than expected. Those who had participated welcomed the ideas for a more pupil focused approach to reading focusing on teaching the alphabet, phonological awareness, vocabulary building and the reading of continuous text with understanding, but said that it depended on the specific resources associated with the project and these were in very short supply.

The CEB training lasts 10 days and introduces the teachers to the approach and content of the new curriculum. Whilst teachers were glad to have taken part they found it too short and too general to affect their practice in either mathematics or reading. Some said that they 'received information' rather than actively engaging in the concepts taught and once again no specific difference was noted between teachers were taken part and those who have not.

Tanzania

CPD in Tanzania historically has meant either upgrading qualifications or short courses that include early reading called the '3 R's' or 'KKK'. Like Kenya and Uganda, teacher resource centres (TRC) are used and have greater potential to support teacher development. However, the SACMEQ data reports that only 40% of teachers said they had visited one, approximately 9% said they did not have one and 10% said they had never used theirs (Mrutu, Ponera et al. 2005). Most teachers used the TRC to talk to others, but not to make their own materials. A small minority purposely interviewed for this study in Shinyanga region had attended Education through Quality Improvement through Pedagogy (EQUIP) focused on the diagnostic teaching of reading and writing through child centred teaching methodologies. It was found to be useful by participants: *'teaching in primary schools and EQUIP training enabled me more to become a good reading teacher in lower grades...'* (Teacher, Tanzania).

The Children's Book Project encourages teachers to write, produce and use their own reading materials (Inyega 2009) and has a high profile in Tanzania reaching 146 primary schools and 3, 375 teachers with 262 lead teachers trained. Tanzania has developed a five year strategy (In-Service Education and Training Strategy for Primary School Teachers) to ensure the development of adequate quality primary school teachers through continued in-service and training and professional growth (United Republic of Tanzania, 2010).

According to teachers interviewed by the TPA, through KKK they learnt how to make and use teaching aids to teach young children mathematics, how to assist pupils to recognize and write numbers, how to teach mathematics using various methods including songs and plays. Again in Tanzania the quality of teaching and learning in classrooms where teachers had participated in CPD programs involved more pupil participation and activity. For example one teacher said she had to hand over the learning to her pupils: *'I should not be chewing food for them and all they do is swallow.'* She considered that keeping her young pupils busy kept them calm - with such large classes it was not possible for them to walk around the classroom without disturbing many.

Uganda

As with the TAC tutors in Kenya, CPD in Uganda is predominantly the responsibility of the Department for Teacher Education through the Teacher Development and Management System (TDMS) structures. They are managed by Coordinating Centre Tutors (CCTs) who are part of the college staff but are deployed to coordinating centres (CCs) where they lead the professional development activities for teachers, principals and school management committees. CCTs train the teachers and principals in various areas that are often identified through consultation at school level.

Workshop topics are very general often include HIV/AIDS, child-friendly schools, TLMs, continuous assessment, counselling and guidance and some mathematics and reading. The cascade approach is used in CPD programmes, with tutors receiving the training and then going on to train the teacher trainees and practising teachers.

More informal CPD in Uganda is characterised by a greater use of more experienced teachers training their colleagues through informal half day sessions in-school or a cluster of schools. There is a high teacher use (75%) of teacher resource centres in the North and Eastern regions for in-service and to speak to other teachers but not so often to produce or borrow materials for reading (Byamugisha and Ssenabulya 2005). Thus, a relatively high percentage at 46% of teachers in this study report having had some form of CPD but the majority of this is the orientation for all teachers towards the new thematic curriculum for P1-P4. Uganda is about to launch a national programme of improving tutor knowledge through employing overseas primary consultants. A two year probationary Teacher Education curriculum has also been developed in Uganda and is in draft form, intended to effect a mandatory school-based mentoring system for newly qualified teachers.

There are no reliable reports of CPD programmes specifically targeting the teaching of reading and mathematics. This is in spite of the responses of 42% teachers in the survey who indicated that they had ever attended such CPD programmes. Teachers observed teaching mathematics and reading, had attended training through school-based CPD or through Coordinating Centre Tutors seminars and workshops and generally said they appreciated the role that this training played in improving their practice. All said that they had learnt some new ideas from such training and acknowledge the contribution of more experienced teachers in grounding them in their profession. As in the other East African countries these teachers encouraged more participation from approach to learning and tended to maintain a faster pace in their lessons.

5.4 The contribution of CPD to the teaching of mathematics and reading

The literature on in-service training presents a fairly dismal view and the TPA data in West Africa do not contradict this, possibly in part because in Senegal and Ghana the teachers involved were inexperienced. In East Africa however, although the project was not able to evaluate in any detail the effects of specific programs a rather different picture emerges. In spite of the gaps in their initial training, experienced teachers can build upon their years of teaching, and make some use of the CPD programmes they have attended, contributing to their confidence and development of pedagogical content knowledge. Even though they structured their lessons in a similar way to NQTs this 'good' category of teachers had developed reading pedagogies that were more appropriate to the large classes and pupils appeared to learn to read more effectively in their classrooms and drew actively on their knowledge and pedagogical content knowledge to make instructional decisions. These pedagogies differed to NQTs in six specific ways.

- More participatory, learner-centred approaches including the use of mixed ability group work.
- They gave their lessons at a faster cognitive pace that led to a sense of progression, so moving through content more quickly and keeping pupils engaged.
- Some teachers with more experience of CPD often showed deeper understanding of how to draw on two or more languages and to use code switching
- A more integrated use of teaching and learning aids, involved using flash cards, pictures, real objects; in Kenya with RTI and in Tanzania with the Children's Book Project, some teachers wrote stories themselves that they read with the children and this seemed to facilitate a greater focus on comprehension skills and was shown in pupils who read faster and with greater fluency.
- A diagnostic approach to assessment that meant identifying children who were not following or understanding the text and focusing on approaches to support them.
- A more reflective approach: Especially in Kenya and Tanzania teachers with significant CPD experience were more willing to acknowledge that if a child could not read it may be the fault of the teacher, or were able to pinpoint what their own weaknesses were in the observed lesson and how they would alter this.

What seems to be happening is that in the research with experienced teachers is that some of them were able to draw on their experience and integrate ideas from the extra input they received into their practice. However, there needs to be some caution. The continuum of teacher learning is not embedded systemically in any of the countries. What we have come across in the east African countries are some teachers who are able to construct such a continuum through their own special efforts. The numbers involved are not great and there may also be some sample bias in that those teachers who offered themselves and were selected for CPD programs may also have been those who were more enthusiastic and reflective. Moreover the complexity of the field of CPD programmes in the countries studied means that in order to conduct a study more focused on evaluating the approach and content of specific programs and their effect on pupils' learning would require a much longer spent in the field in order to identify a larger sample of what are often quite widely dispersed teachers.

Chapter 6 Costs and Efficiency

6.1 Introduction

The purpose of exploring costs in a study of teacher preparation is to address two main issues, one of which relates to tutor-trainee ratios and its relationship to costs per trainee, and second the implications for improving effectiveness – that is to address the question: what teaching group sizes would optimise efficiency in the preparation of a lower primary mathematics or reading teacher. Group size is important for reasons that have to do with opportunities for engaging trainees in practical learning in colleges and the resources associated with it. If small group work activity and tutorial support is to be promoted to enhance the professional learning experience of trainees, then ensuring relatively small class sizes under conditions of improved instructional resources is important. The costs and efficiency analysis looks at the relationship between class sizes, tutor-trainee ratio, teaching periods per week and the cost per trainee. Data from the two francophone countries (Mali and Senegal) and two of the Anglophone countries (Ghana and Kenya) are used for the analysis⁷. In order to make categorical statements about the cost effectiveness of any of the individual programmes we would need to have a great deal more complex data, but the analysis presented here raises issues which might start a discussion amongst policy makers.

6.2 Assumptions⁸

This analysis looks at the elements of the college based training that are directed towards how to teach language and mathematics and need to be considered along with the issues raised in previous chapters about the balance between methods teaching and subject content teaching. The cost per trainee (Ct) can be shown as a function of average tutors' salaries ($AvTs$) and tutor to trainee ratios⁹ (TTR). In general, economic concern with cost efficiency would imply minimising $AvTs$ and maximising TTR in ways consistent with maintaining quality. But this will depend on what is delivered to trainees in the college mathematics and reading curriculum, which will also depend on salary costs per trainee and how this translates into tutors contact hours with trainees and the work which surrounds these contact hours. So, for example, a tutor could teach a group of 100 trainees to maximize cost efficiency, but the constraints on resources and intensity of practical learning activity would mean this is achieved at the expense of cost effectiveness – high practical/group learning intensity at sustainable costs. The cost and efficiency question is whether lower tutor salary costs per trainee and higher trainee-tutor ratios can be achieved without necessarily diminishing trainee contact time or practical intensity. Addressing this and other related questions is important because of the implications for (re) structuring the TTC reading or mathematics curriculum, the resources required to deliver the curriculum, and the number of tutors that might be needed to optimise teaching group size. It is worth pointing out that recurrent teaching costs per trainee will rise with average tutors' salaries and fall as the TTR increases.

The main cost drivers can be separated into recurrent, salary and non-salary costs, and into fixed and variable costs. Recurrent salary costs are due to teaching faculty and support staff (Lewin, 1999). In our analysis we have assumed non-teaching salaries in the colleges relative to teaching salaries to be small. We have also excluded capital, equipment and supplies, and other costs such as maintenance, repairs, services etc.

Ghana

Data on class size, number of trainees and staff was collected in all four TTCs surveyed and trainee-tutor ratios (TTR) calculated (table 1). Based on the data the following observations can be made. College 4 has relatively low teaching loads for the same amount of periods a week in mid-sized groups. In colleges 1, 2 and 3 teaching loads are relatively high for the same contact time for group sizes that are also relatively high. It is not surprising, therefore that, trainees in the focus groups reported the prevalence of lectures and note-taking in their methods courses.

⁷ Data from Tanzania and Uganda were not sufficiently complete to be included in the analysis

⁸ The methodology for the cost and efficiency analysis is informed by Lewin's (1999) MUSTER discussion paper 1 on "Counting the Cost of Teacher Education: Cost and Quality Issues"

⁹ See appendix 1 explaining the mathematical relationship.

The recurrent teaching costs per trainee based on the calculation between average teaching salary and TTR show interesting differences (see annex 1) (table 2). As the data suggest, the number of tutor teaching periods per week is quite low which raises questions about efficiency. Average class contact time of 10 hours per week (2 hours per day) is not excessive. Group sizes could be smaller with larger numbers of contact hours. College 4 has the highest costs because it has a smaller TTR in relation to the average tutor salary. If it employed fewer tutors, the costs would drop because TTR would reduce. However, this has to be balanced against the cost to efficiency. College 4 could improve its efficiency in relation to the costs per trainee if it increased tutors' teaching periods per week.

If more tutors teach on the methods programme, this will increase considerably the cost per trainee because of the fact that the TTRs will reduce considerably at the current salary levels. Only half the English tutors in College 3 and College 4 teach methods. In Colleges 1 and 2 this is a fifth and a third respectively. Thus, if all tutors taught the methods courses the TTRs would be much lower and potentially improve the trainee learning experience by reducing the average teaching group size, but this will come at a higher cost per trainee.

Table 6.1: Efficiency indicators in 4 colleges

College	Class Size English	Class Size Maths	Number of Trainees ¹⁰		Number of Tutors ¹¹		Trainee-Tutor Ratio (TTR) English	Trainee-Tutor Ratio (TTR) Maths
			1 st year	2 nd Year	English	Maths		
1	45	50	300	310	5 [2]	6 [3]	62	52
2	45	50	301	299	6 [2]	6 [3]	50	50
3	45	45	272	267	4 [2]	5 [2]	67	53
4	35	37	300	350	8 [4]	8 [4]	44	44

Table 6.2: Efficiency indicators and unit cost

College	Number of Trainees	Number of Tutors ¹²	Trainee-Tutor Ratio (TTR) [Reading/Math]	Cost ¹³ per Trainee Salary Tutor ¹⁴ 3600GHS) Cs [Reading/Math]	per (Av per = Average Teaching Group Size	Number of Trainees Teaching Periods per Week ¹⁵	Teaching Load ¹⁶
1	310	2	155 / 103	23 / 35	45	10	34
2	299	2	150 / 100	24 / 36	45	10	33
3	267	2	133 / 133	27 / 27	45	10	30
4	350	4	87 / 87	360 / 360	35	10	25

¹⁰ In the first year training focuses on content knowledge. Year 2, semester 1 is when methods courses are taken. We use the trainee number here for the calculations

¹¹ Number in bracket represents tutors who teach methods only and would be responsible for teaching how to teach reading and mathematics

¹² Tutors teaching methods including reading in second year second semester: 3 weeks out of 12 for reading related components

¹³ Cost per trainee (CS) = $\frac{AvTS}{TTR}$

¹⁴ Assuming average tutor salary of 300 GHS per month equivalent to 3600 GHS a year equivalent to \$2491 (1USD = 1.445GHS)

¹⁵ This is based on average of method tutors teaching period per week

¹⁶ Teaching load is an indication of the effort of tutors which factors in class size and the number of periods taught.

Kenya

Efficiency indicators for the 4 TTCs in Kenya are presented in tables 3 and 4. They show an even higher trainee-tutor ratio for both English and Maths. Teaching group sizes are more than double that of Ghana. Class size in College 1 is high compared to the other 3 colleges.

The average tutor salaries in the four colleges differ considerably which has implications for the costs per trainee. For English the cost per trainee is Ksh163, Ksh438, Ksh472 & Ksh551 respectively. For the total number of trainees, college 4 has relatively high costs per trainee due mainly to the fact that it employs more tutors to achieve a lower TTR. College 1 is able to achieve lower costs per trainee because of its high TTR. College 2 average teaching group size is slightly lower than that of College 1. For Mathematics, the cost per trainee is: Ksh163, Ksh370, Ksh344 and Ksh359 respectively. Again, it is clear that College 1 has the lowest costs per trainee because of the relatively high TTR. What is interesting is that the difference in cost per trainee for mathematics is not as wide as in English. This is likely to be due to the salary scale of the tutors. In effect, if tutors on average are on a high salary scale, the cost per trainee is likely to be higher for the same number of tutors and trainees. The opposite will also be true.

If Colleges employ more English and Maths tutors they would reduce the average teaching group size and potentially improve the quality of contact hours, but this is likely to increase costs per trainee if average salaries increase. Organising instruction around teaching groups in one place – the college classroom – is unlikely to allow for hands-on exploratory work where trainees work in groups with the classroom discourse characterised by investigations and practical activities. A more efficient way to improve professional learning at the level of costs indicated would be to shift much of the responsibility for learning to trainees, and allow tutors to act more as facilitators. This could be achieved with the current level of staffing. The organisation of learning in TTCs is very similar to that of secondary schools where trainees sit in rows listening to the tutor with little interactive space for activity learning and group work.

By keeping the teaching size the same as the TTR, tutors are able to have relatively low teaching loads per week, but this diminishes the intensity and quality of group interaction. It is important to note that what is delivered in terms of taught time (taught hours per week) for a particular cost, is a function of the number of trainees per tutor, the amount of teaching associated with the teaching posts and the average teaching group size. If group size is reduced this could potentially increase the teaching load. The bottom line is that, professional learning for trainees should operate under conditions that allow for smaller group sizes, otherwise tutors are likely to adopt teaching approaches that are less interactive (e.g. lectures and note taking).

Table 6.3: Efficiency indicators in 4 colleges

College ¹⁷	Class Size	Class Size	Number of Trainees		Number of Tutors		Trainee-Tutor Ratio (TTR)	Trainee-Tutor Ratio (TTR)
	English	Maths	1 st year	2 nd Year	English	Maths	English	Maths
College 1	84	84	340	330	2	2	170:1	170:1
College 2	40	40	510	490	10	7	102:1	128:1
College 3	43	43	435	415	7	5	109:1	145:1
College 4	37	37	350	320	7	6	88:1	117:1

¹⁷ Except for College 1 where the two teacher educators teach both first year and second year classes, in the rest of the Colleges half of the tutors teach first years and the other half teach second years. Therefore for these three Colleges, the Trainee-Tutor Ratio (TTR) for both English and Maths is calculated using half the number of educators in the respective colleges.

Table 6.4: Efficiency and unit costs: English

College	Number of Trainees	Number of Tutors	Trainee-Tutor Ratio TTR	Average Salary per Tutor (in Ksh.)	Average Teaching Group Size	Number of Trainees Teaching Periods per Week	Teaching Load
College 1 ¹⁸	670	2	170:1	27,760	170	16	16
College 2	1,000	10	102:1	44,700	102	14	14
College 3	850	7	109:1	51,500	109	18	18
College 4	670	7	88:1	48,500	88	14	14

Table 6.5: Efficiency and unit costs: Mathematics

College	Number of Trainees	Number of Tutors	Trainee-Tutor Ratio TTR	Average Salary per Tutor (in Ksh.)	Average Teaching Group Size	Number of Trainees Teaching Periods per Week	Teaching Load
College 1	670	2	170:1	27,760	170	14	14
College 2	1,000	7	128:1	47,400	128	12	12
College 3	850	5	145:1	50,000	145	12	12
College 4	670	6	117:1	42,000	117	12	12

Mali

In Mali the accelerated SARPE program is taught by education inspectors and advisers as part of their normal duties. The cost of training then to a certain extent also constitutes opportunity costs.

Table 6.6: Efficiency indicators in 3 Colleges and 1 SARPE¹⁹

Institution	Class size French/reading	Class size Maths	Number of trainees		Number of tutors		TTR French	TTR maths
			Year 1	Year 2	French /reading	Maths		
College 1	245	245	183	288	4	4	61 :1	61 :1
College 2	187	187	186	248	4	4	42 :1	42 :1
College 3	149	149	183	186	4	4	37 :1	37 :1
SARPE	135	135	N/A	N/A	1	1	135 :1	135 :1

In the colleges subject methods (including mathematics and French) for primary schools (grades 1-6) are taught by educational psychology tutors to 3rd year trainees only in the January term. College 1 had 8 psychology tutors in 2009/10, but only 4 were responsible for teaching all primary level subjects equivalent to 4 classes of 3rd year trainees with 10 hours of methods teaching scheduled per week per class. College 2 had 12 educational psychology

¹⁸ College 1 pays tutors a standard monthly salary of Ksh. 27,760

¹⁹ There are 2 hours of instruction in mathematics teaching in the IFM per week and 18 hours of instruction in mathematics education at the SARPE. There are 2 hours of instruction per week teaching French in IFMs. There are 18 hours of methods teaching of French in SARPE

tutors in 2009/2010, but only 4 were responsible for teaching subjects in primary school classes for 4 classes of primary trainees (3 classes of primary trainees on the three year course, and 1 class of those on the one year course). As at College 1, tutors are expected to spend 10 hours teaching elementary subjects per week per class. There were 8 psychology tutors at College 3 in 2009/2010, but 4 of them taught the subject teaching in primary classes of trainees – all four of the three year course. Thus, as in Ghana and Kenya, not all tutors teach methods of reading and mathematics which partly explains the relatively high TTRs except in College 3.

The SARPE training began in January 4, 2010 ending March 20, 2010. The trainers spend 3 weeks on upgrading "sarpies" subject knowledge (revision of general education) before starting to teach subject methods for primary schools. The mathematics education instructor spent 18 hours per week (Monday to Saturday – at 3 hours of mathematics per day). The same amount of time is spent teaching French (including reading) – 18 hours per week. The programme is short in duration uses only one tutor, however because there are fewer trainees the cost per trainee is much lower. It is also unlikely to provide intense practical learning since the organization of instruction is tutor-centered and the class size compared to the colleges is high. If it hired an additional tutor the group size and TTR would reduce but the cost per trainee will increase.

In comparing the regular program with SARPE, we immediately see that keeping salaries at the same levels makes the college program more expensive in terms of cost per trainee. Because they have smaller class sizes, the college programs are potentially more effective in terms of the costs. College 3 has the lowest TTR which may be good for the tutor trainee contact time and professional learning opportunities, but it comes at a higher cost per trainee. However, this needs to be balanced against the fact that only educational psychology tutors teach methods courses.

The SARPE program was introduced as a cheap alternative to the full training offered by the colleges, made more expensive by their residential nature and the length of the course. However the research showed that the amount of time devoted in activities that focused on how to teach mathematics and reading was actually greater in the SARPE. This raises the question about whether it is cost effective to have teacher trainees spending the majority of their time being taught what is essentially a secondary school curriculum in the context of a teacher training college. Moreover, as NQTs the difference between ex-sarpies and college graduates was not discernible.

Table 6.7: Efficiency variables and costs: French & Mathematics

Institution	Number trainees	Number of Tutors	TTR	Average salary month	tutor per	Cost per Trainee	Average class size	Sessions per week per class	Hours per week
College 1	245	4	61	150.000fcfa/		2459cfa	61	2	16
College 2	187	4	42	150.000fcfa		3571cfa	42	2	16
College 3	149	4	37	150.000fcfa		4054cfa	37	2	16
SARPE	135	1	135	150.000fcfa		1111cfa	135	6	18

Senegal

Calculating the costs of the salaries of teacher trainers in Senegal is made complex by the fact that they are not specifically tutors in training colleges. Rather these are education inspectors and advisers who have been seconded to carry out the training during the periods when the colleges are in session and are in addition paid a bonus for their training. There are therefore opportunity costs – as they are working as trainers they cannot be performing their other duties. They are paid their normal yearly salary (5,400,000 CFA, approximately \$12,000 per year). However, if their teaching duties exceed 24 hours in one week, which means they are teaching more than four groups of trainees which is the case in all these colleges, then they are entitled to overtime which is paid at the rate of 1916 CFA per hour (\$4.20). Therefore, overtime to each tutor, which amounts to about 900,000 CFA (\$2,000), paid at the end of the school year. The cost is further inflated as inspectors, working for colleges are full time, and do not return to their other assignments at the district level. Compared with their colleagues who are not involved in teacher training their

working year is thus reduced considerably and they gain extra money. Some the inspectors we interviewed agreed that the model was not cost effective.

One way in which this might be made more cost effective would be to acknowledge that the extra hours that are worked during the months when the college is in session are more than compensated by the amount of time when the college is in session and so dispensing with the need for overtime payments.

Another way to cut out the overtime payments would be to involve more inspectors and advisors in the work in the college but to expect all tutors to return to their district duties at other times of year. This would enable greater collegiality and support for the tutors while teaching but would give less opportunity for them to specialize and build up expertise in training teachers. Tables 6.8 and 6.9 also demonstrate that there is a wide discrepancy between colleges as far as teaching load for the tutors is concerned so there may be a case for adding an extra tutor for each subject at college 4 in particular.

Since there are so many teaching groups following parallel courses, greater efficiency might be gained by increasing class sizes. However as argued above this is not advisable on educational grounds in that larger classes would make interactive pedagogies more difficult and on practical grounds of shortage of larger rooms. Senegal tutors have the highest teaching load in hours per week due to the fact that, basically only one tutor teaches the whole group. This is a recipe for ineffectiveness in terms of professional learning outcomes as this is likely to increase the use of lectures instead of learning through group work activities and investigations.

Table 6.8: Efficiency indicators in 4 colleges

College	Class Size English	Class Size Maths	Number of Tutors		Trainee-Tutor Ratio (TTR) French	Trainee-Tutor Ratio (TTR) Maths
			French	Maths		
College 1	273	273	1	1	273	273
College 2	187	187	21	21	187	187
College 3	365	365	21	21	365	365
College 4	650	650	31	31	650	650

Table 6.9: Efficiency variables and costs: French & Mathematics

College	Number of Trainees	Number of Tutors	Trainee- Tutor Ratio TTR	Average Salary per Tutor	Average Teaching Group Size	Number of Trainees Teaching Periods per Week	Teaching Load
College 1	273	1	273	6.3 m CFA (=\$14000)	40	10	68
College 2	187	1	187	6.3 m CFA (=\$14000)	32	10	58
College 3	365	1	365	6.3 m CFA (=\$14000)	45	10	81
College 4	650	1	650	6.3 m CFA (=\$14000)	54	10	120

One further issue to consider in Senegal is that of the allowances paid to trainees. This consists of 20 000 CFA (\$43) per month per trainee. For a large college such as College 4 this adds up to a considerable amount. However, this allowance is necessary as colleges in Senegal are not residential. In one of the focus groups trainees maintained that

the allowance is insufficient to cover daily travel and living cost. In Ghana by comparison the allowance is nearly three times as large where no travel costs are incurred and food is provided.

6.3 Conclusions

The key lessons from the cost and efficiency indicators are as follows:

If tutor-trainee ratio is reduced, allowing more tutors to teach methods, the recurrent teaching costs per trainee will increase if the average tutor salary is kept at minimal levels, (This is based on the calculation of Cost per trainee: $CS = \frac{AvTs}{TTR}$, see appendix 1), which raises the question of what might be gained by reducing the average teaching group size and increasing the number of method tutors who teach reading or mathematics. If group size is reduced without increasing the number of method tutors, teaching loads will increase and this could potentially reduce learning efficiency. But if more tutors are employed this is likely to increase TTRs and potentially increase the cost per trainee as the formula suggests.

It is important to stress that for ITE, high ratios should be thought of as unsuited for delivering an ITE curriculum that requires trainees to engage in learning activities with extensive exploratory or reflective work, which is what we believe will significantly improve the training experience along the lines recommend in this report. In all the college classroom observations, teaching was organised in large groups where the lecture method was common. Although this ensures low costs per trainee, it is unlikely to produce rich and diverse instructional practices where group work and activity learning is the focus.

Where tutors engaged students in demonstrating methods of teaching reading or basic mathematics, this was still organised from the front of the class, whilst trainees observed. What training systems should avoid are situations where there are high costs and low teaching loads and taught time. The analysis shows that some colleges can deliver a similar number of taught hours to similar size groups, but it is possible for some to achieve this at a lower cost as a result of higher teaching loads. Generally, the examples show how the key efficiency parameters interact. In reaching any decision about how to improve learning experiences in the colleges, teaching group size and teaching load should be the critical factors. Although reducing TTRs can increase costs per trainee this has to be looked at also in terms of the potential for improving the quality and efficiency of learning to teach.

This analysis has concentrated on the costs of college based work. However Lewin and Stuart (2002) contend that the most expensive part of teacher training is the practicum. In all countries except Senegal the main practicum is at the end of the course; part of the rationale for this is cost reduction. Placing it here means that trainees are non-residential. However in Ghana and the East African countries, it is still dependent on funds being available for tutor travel and subsistence. When these are not available then trainees are unsupervised and the link with the college is broken. This is in any case the issue in Mali where responsibility for the practicum lies completely with the district education offices. We have argued that the conceptual division of theoretical training from practical training is not conducive to training effective teachers. The separation of trainees on practicum from the college and their tutors contributes to this. So whilst minimizing tutor contact through a long final practicum may be efficient, structures which support a practicum embedded in and interacting more fully with the college course may well be more cost effective.

Chapter 7. Conclusions and recommendations

The cross-sectional approach adopted by TPA enabled us to gain a good view of what the different curricula prescribed and advocated, how this was being translated in the colleges and then to see how it was working out in schools. Ideally one would undertake longitudinal research following individual teachers through their training and into the classroom, but it is doubtful whether the gains would have outweighed the much longer and more labour intensive fieldwork. Our analysis showed that in all the countries the gaps were many and deep. For anybody who has studied teacher education in any situation, the existence of these gaps is not surprising. However, unlike other research on teacher education the TPA study looked specifically at the teaching and learning of mathematics and reading partly because these two subjects are seen as those most vital to primary pupils' learning and progress overall. Without them the other parts of their schooling are not meaningful. However the narrower focus also allowed the project to look much more pointedly and with much more depth at the specific learning of teachers and how this translated into the specific learning of pupils in the classrooms. Our analysis of the gaps is therefore also more pointed.

Generic issues around the structure and content of college training are discussed in this first section of the conclusion. The research questions are then addressed directly for reading and maths followed by specific recommendations. An alternative approach to teacher education that could also enhance the teaching of early reading and mathematics is described at the end emerging from the research findings as a whole.

7.1 General teacher education issues

7.1.1 The need for subject content knowledge

In this project we have debated the role of subject content knowledge and the extent to which it is necessary for successful teaching. In the research we came across examples of trainees and teachers who felt that lack of subject content knowledge was preventing them from teaching well. However in most of the colleges more effort was spent in teaching and assessing the content knowledge of trainee teachers than in addressing issues about how primary pupils might be helped to gain it. Even in the two accelerated systems in Mali and Senegal content knowledge was specifically taught. The project was not designed to make a direct comparison between courses but there is little to suggest that paying greater attention to subject content knowledge in teacher training colleges in Africa is rewarded by better teaching in schools. This may be partly about the nature and level of subject content knowledge that is introduced where what is important is deep understanding at a conceptual level of the material of the primary curriculum, rather than superficial knowledge of what successful pupils may be confronted with later on in their education. It is often only when people are asked to teach something that they realize the level of their understanding and are led to deepen it – an idea exploited in other situations (e.g. Pask 1987). If subject content knowledge needs to be deployed for primary school teaching, then it needs to be learnt in the context of primary school teaching and not separate from it.

7.1.2 Assessment

In many colleges, the summative assessment of the College course subverted the intentions of the curriculum by directing trainees to focus on being able to demonstrate propositional knowledge rather than pedagogical knowledge and practice. Most ITE systems included the assessment of practice, but this was often less important or less stringently applied than the examinations sat by the trainees. In Uganda for example, grading criteria of the promotional examinations, as well as the examination content, were described by trainees in the initial survey as largely coming from outside the teaching syllabus and sometimes well beyond the content knowledge they considered appropriate to teach in primary school. In re-conceptualizing the ITE curriculum we recommend a greater focus on those aspects of the teacher education experience that are will be most influential in helping trainees become pre-disposed to understandings and practices that will make them good teachers. This is unlikely to be through examinations, but through innovative assessment practices such as portfolio or performance-based

assessment determined by observed practice and assessment items which demand more open-ended responses based on typical scenarios of practice in the particular country context.

Whilst most of the teacher education curricula spoke of formative and diagnostic assessment, in practice they received very little attention in observed sessions and in the discourse of tutors and trainees; during the fieldwork in schools they were very noticeable by their absence. Formative and diagnostic assessment are a crucial part of the competency-based curricula that are being introduced in many countries as they are the means by which the situated activities of the pupils may be developed into conceptual knowledge and understanding. This kind of assessment is the means through which teachers become responsive to pupils and they are associated with classroom practice that is focused on pupils' learning rather than teachers' delivery of prescribed package of knowledge. Raising teachers' awareness of formative assessment is a significant way of focusing their attention on pupils learning and ensuring that their pedagogy is more interactive (Pryor and Lubisi 2002). The aspirations of the primary curricula towards constructivism, active learning and reflective practice means that teacher education needs to introduce assessment tasks which demand much more than information about theoretical knowledge, those "which include evaluation of teaching context and the pedagogical choices that teachers make in relation to that context" (Stuart, Akyeampong, Croft, 2009 p 94).

7.1.3 Trainee motivation and loss of confidence

Where new ideas and new practices are being introduced, there is potential for those at the start of their career to be a dynamic force for driving the change. However, because attempts to improve teaching in schools through curricular change in the countries we studied have not placed initial teacher education at the centre of their planning and implementation, this potential has not been met. Instead, the research found that newly qualified teachers, arriving in schools with the confidence of having successfully completed their training, often find that it has equipped them to deal neither with the difficult realities of large classes and lack of resources, nor to make the most of the possibilities offered by carefully planned and developed curricula. This can lead to demotivation and diminution of ambition and is subverting the effort that is going into curriculum reform

7.1.4 Time devoted to training

In all the countries trainees, trainers and NQTs complained about the lack of time for training. This was so both in the longer courses and in the accelerated courses seen in the two Francophone countries. The original motivation behind Senegal's adoption of an accelerated system was concerned with the rapidity whereby it might increase the number of teachers available. However, as well as the time factor, cost is significant. Various studies carried out by PASEC and reviewed by Bernard et al. (2004) reached the conclusion that formal teacher preparation often has little effect. In cases where effects were documented, they were generally moderate and sometimes were in the wrong direction (see also Akyeampong & Lewin 2003). In some cases, it was found that the success of the pupils in the classes of teachers without formal preparation was on a par with those taught by the fully trained teachers. As far as Senegal is concerned, the PASEC research (Bernard et al. 2004) found that pupil progress in grade 2 was virtually identical for volunteers and civil servant teachers, whilst in grade 5 on average pupils did a little better with volunteer teacher. However, the differences were small enough for Bernard et al (2004) to conclude that overall progress was the same with both types of teacher. In Mali a small advantage was shown by pupils of contractual teachers rather than civil servants at both grade 2 and grade 5. However once again the sample was mainly locally recruited community teachers rather than those who had gone through the SARPE training.

Some have jumped to the conclusion that initial teacher education is not a worthwhile investment and could perfectly well be confined to very short courses rather than spending large sums on long training courses. It seems to us that, on the contrary, these studies [by PASEC] ought to provoke the kind of questions that might lead to a change in training practices. (Bernard et al., 2004:18 – authors' translation from the French).

7.2 Responses to the research questions

1. How do pre-service teacher education programs prepare trainee teachers to teach reading and mathematics in the early grades?

The structure of the pre-service training programs pivots around the teaching of a body of propositional content knowledge with methods for teaching primary school content taught separately and assessed through examination rather than practice. Only a very small proportion of the ITE curriculum is devoted to teaching trainees how to teach early reading as it is just part of a language curriculum that in itself competes with other subjects for time on the timetable. For both reading and maths there is a greater focus on developing the literacy and numeracy skills required for upper primary. The practicum is very short at two months in most countries and takes place after formal learning at the college at the end of each college year. Even where as in Mali or Ghana there is a full year out in schools, there is no system whereby trainees are guided and supported by expert teachers in the practicum schools nor planned opportunities for critical reflection on their practical teaching experiences with their college tutors. Supervision by tutors can be erratic and dependent on the availability of college funds and transport or not planned in at all.

There are two key implicit assumptions about learning to teach reading and mathematics that can be deduced from this structure: first, that ITE can only introduce some general concepts and pedagogies around the teaching of reading and maths with the expectation that full training and development will take place later in schools; second, there is an assumption that trainees will be able with little difficulty to turn subject content, and methods, taught separately, into pedagogical content knowledge when they are on their practicum.

In every country there is a discrepancy between what is required of teachers to teach the primary school curriculum and the preparation that they receive to do this from their initial training. Curriculum development at primary level is more frequent and more detailed than in teacher training, and more resources and more energy are mobilised for it. Primary curricula are thematic and competency-based and call for a more learner-centred approach to teaching than in the ITE curriculum. There is an assumption within the curricula that teachers have been trained to understand the concepts that underlie them and know how to use pedagogies appropriate for very young children in large classrooms who may often be unfamiliar with the language of learning and who may or may not have attended nursery or pre-school.

The primary school reading curriculum and objectives generally present details of learning to read in the early grades that encompass pre-reading skills, word, sentence and text level skills with decoding integrated with comprehension. Competences are couched as activities such as matching words with pictures or retelling a story rather than specific benchmarks but in all the primary curricular there is an expectation that by the end of three years in school children will be able to read short texts with fluency and comprehension. In contrast, the ITE curriculum focuses on content knowledge of 'language' rather than reading, with a narrow focus on the sequential decoding of words for lower primary. More time is given to comprehension and reading different text types in upper primary, reading skills sometimes not considered appropriate for younger children. The results of the various systemic evaluations carried out in all the countries by PASEQ, SACMEQ and more recently by EGRA suggest that by this time it is too late. The primary school maths curricula also present details of maths content, often in the form of activities including pre-number with a strong focus on moving from the concrete and simple to more abstract taught through varied teaching aids. This has a closer alignment with the ITE mathematics curriculum.

2. How do trainee teachers develop their understanding of teaching reading and mathematics to early grade students?

Trainees in this study replicate the way they have been trained by their tutors through lectures, simulations of primary classrooms or tutor-directed group or independent research. Their tutors rarely have primary school experience themselves and often do not have direct access to the current primary curriculum, textbooks or teaching and learning

resources to support their teaching. In reading, trainees draw mostly on a limited technical word level approach, either synthetic or analytic, skills which they find easier to teach than reading rate, fluency or text comprehension which they find difficult. 'Look and say' and the phonics approach are dominant in Ghana and Kenya, a phonics to syllabic and word approach in Tanzania and Uganda and also in practice in Mali and Senegal within a supposedly global/mixed approach. Trainees are unconfident in teaching reading in local languages although more positive about this than their tutors who themselves may not know or be fluent in the local language or trained to teach early reading in it.

In maths, trainees placed emphasis on sequencing, the use of concrete apparatus, and tutor or trainee demonstration of prescribed methods. Much of the focus was on how instructional materials could be used to teach basic mathematical concepts, although this was at a superficial level. Critical discussion of the primary curriculum for early reading and maths was not the tutors' focus in either reading or maths college sessions.

Orientation to the primary curriculum was short at two to three weeks and based on preparing schemes of work and lesson plans for one particular topic of the primary syllabus only. The practicum was not long enough to develop trainees' pedagogical content knowledge and practice in reading and maths and sometimes they did not get to observe or even teach a reading lesson in lower primary. There was little opportunity to engage as apprentices in the practices of the experienced teachers they did observe and little proper mentoring or guidance in schools. Critical reflection of their experiences was difficult when trainees returned to their homes at the end of the practicum for the vacation rather than to the college.

The bald facts of very low pupil attainment in the classrooms where they are being trained to teach early reading and mathematics are not part of trainees' knowledge base. There is an assumption from tutors that either trainees already know the reality of low pupil attainment in reading and maths and the classroom conditions in which they learn, and do not need to be reminded of this in the college, or that they need to be taught to some 'ideal' construction of a primary classroom in order initially to grasp key concepts and only later to apply them in real classrooms. This is a fundamental weakness in the ITE programmes in the six countries. The gulf between what ITE does in preparing trainers to teach reading and mathematics successfully, and what is required to support meaningful learning of the subjects is wide and can only be bridged if more attention in training is placed on learning through reflections on practice.

3. How do newly qualified teachers teach reading and mathematics in their first few years of teaching?

Reading

Lessons are delivered mechanically with little criticality or concern for their pupils' understanding, attainment or adherence to expectations of attainment. As NQTs they are not well versed in reading pedagogies appropriate for large classes of young children and so decoding of words and short sentences taught through oral repetition and whole class choral work becomes the dominant pedagogy which sometimes prevents rather than supports pupils to develop their reading abilities. Pre-reading skills and print concept were assumed skills even in grade 1. NQTs were uncertain in their knowledge of local languages but drew on code-switching, often in ways which enabled them to proceed with the lesson rather than bridging pupils' understanding, even when this went against college practice. Gaps in their knowledge and pedagogical content knowledge of reading were substantial: systematic understanding of phonics; a range of approaches to decoding; the importance of reading rate and fluency as skills leading to comprehension; how to teach pupils to read continuous text with understanding; multiple comprehension strategies and the production, management, use and storage of reading materials in local languages (Stanovich 1986; NICHD 2000; Ehri 2002; Commeyras and Inyega 2007; Trudell and Schroeder 2007; Cain 2011).

Mathematics

Newly qualified teachers often start with the concrete but hurriedly move onto more abstract work on the chalkboard. The meaning of what they are doing is often lost to them because the classroom context, and the challenges it presents in terms of using concrete materials productively, does not receive much attention during the ITE phase. Basically the classroom context is not seen as an avenue for developing practical knowledge of teaching — this highlights the importance of the study of practice if the locus of learning to teach is to shift towards problem-based approaches where teachers connect more with the realities of helping children develop understanding in maths and the ability to read with meaning

Some NQTs were able to adapt to the classroom environment more easily than others, especially when they were paired with another NQTs as in Ghana, or were able to learn from colleagues or informal in-school CPD as in Uganda and Tanzania and in rare cases in Senegal, producing reading materials and using them effectively. Few NQTs received expert induction or mentoring by experienced teachers in a systematic manner.

4. What are the characteristics of professional development programs with a mathematics and/or reading focus that have been implemented over the past three years?

The current structure of the ITE training assumes that full and specific development in learning to teach early reading and maths will take place in schools and that systems exist in schools to formally induct, support and supplement the ITE programs. The study found that this was not the case. Only a small percentage of the teachers in this study had received any form of professional development specifically for early reading and maths. They were therefore highly dependent on the primary syllabus, other more experienced teachers or inspectors to support them. Where there was on-going professional development this could be beneficial but was often focused on developing generic teaching skills or introducing new curricula rather than on early reading and maths. These often financed directly by the government fell into three main categories:

- Training based around a teacher's resource centre run by expert teachers addressing specific issues such as continuous assessment (Uganda, Tanzanian, Kenya)
- Training within a school or between a number of schools, organised by an expert teacher (Uganda) or by the school / cluster themselves (Mali, Senegal)
- Nationally organised orientation to the new primary curriculum and including college tutors in this (Uganda, Mali)

At any one time there were also other CPD programs taking place in the six countries often externally funded by NGOs or new areas such as HIV/AIDs or peace education but they all remained small scale, were often one-offs, not sustainable over the long term and were rarely aligned to ITE. Such programs also reached low numbers of teachers in comparison with pre-service training that reaches a critical mass of teachers.

Specific programs on early reading were rare but seemed to provide a short, intensive refresher course on reading to supplement the college training and in this mode appeared to be beneficial. They often contained pre-reading skills, phonological awareness, different approaches to decoding and comprehension, production and use of reading materials in local language. Examples of these were the NALAP program in Ghana, the Children's Book Project in Tanzania and SARENA in Senegal. PHARE in Mali was also of this kind but was reinforced by daily lessons by radio so reaching much larger numbers of teachers. The kind of interest and focus that early reading gets as a specific area for attention through CPD is not extended to Mathematics. The rare exception is Senegal where PREMST focuses on mathematics and science which appeared to be making a small but significant impact. The research has identified weaknesses in the way teachers try to use concrete materials and everyday practical examples into opportunities to develop conceptual understanding in early mathematics. CPD is required to help teachers understand and practice the use of teaching and learning materials in mathematics in ways which shift more of the

focus on how pupils' can use these effectively to promote conceptual understanding, rather than how teachers can simply manipulate them as illustrations.

5. How do the graduates of professional development programs teach reading and mathematics to early grade students?

Teaching experience and the training in school based and out-of-school CPD programmes appear to have a positive impact on teachers' knowledge and skills and on their quality of teaching. Teachers who showed appropriate understanding and whose classroom practice connected better with pupils' learning were few. Often they explained the difference in their practice in terms of inputs from CPD programmes. On the whole programmes that are incorporated in the school's action plan and those that are regularly conducted, at school or other local level, seem to be the ones that these teachers recollected as influencing their approach to teaching reading. However, there remains considerable variation between even experienced teachers strongly suggesting that other factors including school level resources and how teachers reflect and learn from their practice can be hugely important. The potential advantage that CPD has over ITE is that if it is suitably structured, teachers might learn in the context of practice or the CPD is finely tuned to address particular gaps in their knowledge and practice. ITE on the other hand tends to have a wider focus and treats what is required to teach reading or mathematics well in very general terms, often focusing on general principles and methods but teaches a critical mass of teachers.

6. How cost effective are major pre-service and CPD programs with mathematics and reading focus?

Costs and efficiency analysis looked at the relationship between class sizes, tutor-trainee ratio, teaching periods per week and the cost per trainee. Data from the two francophone countries (Mali and Senegal) and two of the Anglophone countries (Ghana and Kenya) were used for the analysis. The analysis provided insights into the implications of different scenarios for improving professional learning and the implications on costs. These insights are important for attempts to restructure the ITE programmes to improve their efficiency.

Tutor-trainee ratios vary considerably across colleges and between countries. This has implications on the costs per trainee which varied across colleges. The cost and efficiency analysis suggests that programmes may not be cost effective if one judged them on how they grouped trainees for learning and the potential outcome in terms of practice. Our analysis suggests that if tutor-trainee ratios are reduced, these can potentially improve the quality of interaction but this can mean higher recurrent teaching costs per trainee. Very high tutor-trainee ratios (TTRs) should be thought of as unsuited for delivering an ITE curriculum that requires trainees to engage in learning activities with extensive exploratory or reflective work, which is what we believe will significantly improve the training experience along the lines recommend in this report. In all colleges, teaching was organised in large groups where the lecture method was common. Although this ensured lower cost per trainee, large class teaching of teacher trainees is unlikely to yield opportunities for trainees to learn in groups and engage in reflective analysis of teaching.

What training systems should avoid are situations where there are high costs and low teaching loads and taught time. Finally, in reaching any decision about how to improve learning experiences in the colleges, teaching group size and teaching load should be the critical factors. Although reducing TTRs can increase costs per trainee this has to be looked at also in terms of the potential for improving the quality and efficiency of learning to teach early reading and mathematics.

Our data did not allow us to reach strong conclusions about the cost effectiveness of individual CPD programs. However, we would argue that prerequisites would be alignment with the content and approach of the primary school curriculum and the structures of school and educational system, sufficient breadth of implementation to reach a critical mass of teachers. Probably most important, given the complexity of changing teacher praxis is that, they should be sustained enabling repeated attempts at translating ideas into practice and discussing the attempts.

7. Which teaching competencies and skills should be incorporated into the curriculum of primary teacher education programs and which should become the preferred focus of teachers' professional development activities?

The research has shown that there is a gap between what ITE programmes aim to achieve and what their newly qualified teachers can potentially achieve in terms of meeting the needs of pupils in the early grades. The CPD programmes in reading offer some insights into how the ITE programme could be structured to connect more closely with what newly qualified teachers will encounter when they enter the real world of teaching and the demands it makes of them. For reading it is important that teacher competencies and skills focus on a holistic understanding and practice of reading which links ability to read to comprehension. The lower primary school reading curriculum should be the main focus and teachers should develop knowledge and skills in analysing and interpreting school materials at college level. The same should apply to learning to teach early mathematics. Leaving NQTs to 'sink or swim' when they begin their teaching career risks losing the investment in their college training. Once trainees have developed the foundational knowledge and skills of teaching early reading and mathematics, this should be strengthened and consolidated with support from mentors in the early career years. At this stage, practical knowledge of teaching reading and mathematics should be the main focus. What is lacking in all six countries are specific competencies and skills that NQTs should be supported to develop during the early career years. That it is necessary is clearly seen from our evidence. Work needs to be done to identify the specific nature of these competencies at school level specific to each country and how they might be identified and validated.

CPD programmes that show potential to rapidly improve teachers' practice in teaching reading and mathematics should be reflected in ITE programmes after they have been evaluated to assess their impact. We did not find attempts to transfer some of the good CPD practices and ideas (e.g. NALAP program in Ghana, the Children's Book Project in Tanzania, PHARE in Mali and PREMST in Senegal) filter into ITE programmes. More needs to be done to bridge this gap.

7.3 An approach to teacher education – learning to teach through the study of practice

From the research across the six countries we have identified eight key factors that are significant in the way that newly qualified teachers develop their knowledge, understanding and practices of teaching. Figure 6.1 shows these factors.

Figure 7.1 Sources of influence on teachers



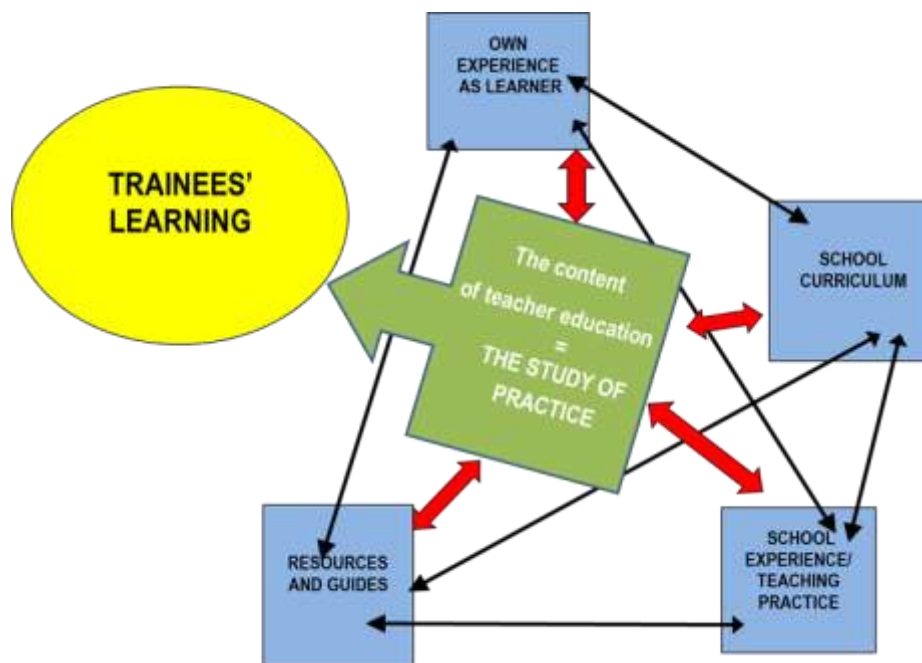
1. All trainee teachers come to their training with what Lortie (1975) termed their "apprenticeship of observation" being what they have learnt about teaching from their own experience as learners. Here of course it is worth noting that those who have reached an academic level sufficient to become trainee teachers will in contrast to many of their primary school contemporaries have found considerable success, whether by the efforts of the teaching they have received or through some other influence.
2. ITE programmes specify through an official curriculum what the government or other authorities require in terms of what trainee teachers should know and do during training and crucially also what is assessed. As we saw in chapter 2, the degree of specificity and detail in these documents can vary considerably, but most are less detailed and less up to date than the school curriculum.
3. The college curriculum may not coincide with the official curriculum. Teaching may also vary from college to college and within colleges depending on the tutors involved, thus affecting the quality of teachers produced in terms of what they know and understand about teaching reading and mathematics in the early stages of primary school.
4. During college-based training trainees may come across and gain familiarity with the primary school curriculum, as prescribed or suggested by the education authorities with content for and approaches to the teaching of children in the early grades. However, availability is not to be taken for granted and in the six countries we found that it is neither studied in great detail nor with a critical eye to its viability in real schools.
5. All the training courses include school experience or a practicum intended to give further opportunities to encounter and get to know the school curriculum. Our research showed that the timing of these is often problematic – a long period after the college course and far away from the tutors separates it from college experience and does not encourage reflection on practice in ways that can improve the integration of theory and practice.
6. Time spent on teaching practice will expose trainees to the culture of schools, and the influence of established teachers. This may include the example, support and mentoring – whether official or unofficial – of teachers or head teachers. Ensuring that trainees benefit from expertise in the schools is important but none of the training systems tap into this resource to enrich trainee knowledge and skills.
7. It is important that trainees and tutors are able to access resources including the student materials and teacher guides. The school curriculum, resources and influence of other teachers will continue to be evident during the period when they start teaching in school as newly qualified teachers.
8. Continuing professional development either through courses or through other means provides opportunities for teachers to enhance skills and reflect on their practice. However CPD is more incidental than planned as a platform for continuing teacher development. Many of the teachers who exhibited promising practices referred to CPD as one major source for improving their practice.

All of these factors are potential sources of knowledge which teachers may articulate to create an understanding of teaching and learning which they can translate into practice. What our research has shown however that is in the different contexts studied and for different teachers, the power and influence of these sources is variable. Where the influence of one source is weak, then others will be relatively stronger. Indeed in many cases this can be seen at a systemic level where, for example, resources and guides are unavailable the College teaching is minimal in that particular area.

What we are proposing is a radical departure from what is currently done. Rather than gaining knowledge through the teacher education course which can then be applied in the practical training and later as a newly qualified teacher in

the classroom, theoretical and practical knowledge should be brought together. Trainee's knowledge and understanding should be constructed through a study of practice (see figure 7.2).

Figure 7.2 A re-conceptualized view of professional learning based on the study of practice



The sources of this would be the knowledge they have themselves of primary education through their own experience as pupils in the classroom. As we suggested in earlier chapters, there are aspects of this which may be useful, but there are also aspects of what they learnt through the apprenticeship of observation that may be unhelpful to them as teachers.

The documents that make up the official school curriculum are another source that can be brought into the College and studied critically. Governments spend a great deal of time and resources on producing these and they contain the aspirations for good learning in schools of the many people who have contributed to them. They may in many respects be greatly different from what trainees have experienced themselves as pupils in terms of structure content and approach. This difference might be a productive way of engaging with them. Rather than learning about the theories of education in an abstract way, critical study of the curriculum would enable them to be introduced as a way of understanding, what lies behind different approaches to practice. School curricula are inevitably aspirational and conceived with an eye to more ideal circumstances than pertain in most schools. Juxtaposing them therefore with trainees' own experience would lead to potentially productive thinking about how they might be applied in real situations.

Even more important in this respect would be bringing forward the current experience of trainees in primary schools, through their observational visits and teaching practice. This would mean that trainees would need to alternate longer time in schools with periods of study in College, rather than having school experience concentrated in one block. However, directed observation with particular tasks for example focused on identifying the learning of particular children, questioning them and attempting to see the lesson from their perspective would be helpful in this. Experienced teachers whose practice is seen as effective in a screening process can be asked to be mentors and coaches, so brought more centrally into the professional learning process of the trainees and NQTs.

Resources and observed practice by teachers in the schools may be contrary in spirit to the official curriculum. This could form a source of ideas to be brought into the teacher preparation process. The point about this is that trainees would develop their knowledge and understanding of practice through comparing and contrasting what they were finding in the different sources. Such an approach would ensure that the ITE curriculum did not lag behind the school curriculum as is currently the case in the countries we studied. Rather than specifying particular content the ITE curriculum would incorporate and change with that of the primary school.

No matter how much time is devoted to teacher education, all the topics of the whole of the primary curriculum can never be covered. However, once teachers have developed ways of following this model of teacher education with practice as the focus for study and with differences and dissonances provoking their thought and planning, they will have learnt not just some ideas to put into operation in the classroom, but a way of continuing to develop their practice as they continue through their career.

Such an approach to teacher education would not be easy to implement, mainly because it would involve teacher educators working in unfamiliar ways. It would involve retraining of tutors, or employing tutors with substantial primary school experience, and ensuring their practical knowledge remains up to date. Tutors' own construction of how to train trainees would have to be rethought. It would involve radical restructuring of the established two year college timetable. It would involve far greater systematic contact with primary schools and school staff to ensure that trainees are supported once in schools to carry out the directed tasks of teaching pupils' in lower primary. Travel costs to and from schools would have to be considered, as would travel costs for tutors to work with identified mentors in schools. Some trainees might have to find accommodation around schools further away if there were not enough local primary schools nearby.

Finally these recommendations call for major reforms of teacher education that require internal and external investments. Tinkering with ITE or shifting much of the investment into teacher development to CPD will not ensure that the majority of teachers leaving TTCs have the right professional disposition and understanding to make a positive difference to children's early learning experiences in reading and basic mathematics.

7.4 Recommendations

7.4.1 Specific issues related to teaching reading

1. The key understanding of reading as a process for making meaning from text needs to be fully established in tutors, trainees and NQTs. Teaching at all levels should emphasize bringing together decoding and comprehension as twinned components of learning how to read. Tutors, trainees and NQTs' knowledge of reading needs to encompass print concept, phonological awareness, phonics, vocabulary, fluency and comprehension - integrated with the multilingual or bilingual classroom. The idea of reading as being linear and sequential rather than a set of lower and higher level cognitive skills orchestrated together needs to be seriously challenged.
2. The teaching of phonics needs to be systematically taught, but as one approach amongst many. Other approaches that trainees and NQTs found more difficult – syntactic and visual methods, identifying words from roots or context – need to be taught in parallel with other easier word level approaches such as syllabic and 'look and say' or whole word approaches.
3. One particular gap identified is how to teach pupils to move from reading – and understanding – a very short sentence to longer texts with a number of linked sentences and leading to a short story, dialogue, poem or description. Trainees and NQTs – and experienced teachers – found teaching story structure and the overall meaning of a text difficult. These need to be discussed and multiple comprehension skills taught in conjunction with real stories. At grades 2, 3 and beyond, the skills of literal and direct inference need to be

taught as well as coherent (inferences made from within the text) and elaborative (drawing on knowledge of the world and experience) inference to make sense of texts.

4. Tutors need to have an in depth knowledge of local languages and the specific approaches to teaching these according to their orthography, and oral and written literature. The need which school curricula are increasingly recognizing for literacy to develop first in a familiar language cannot happen unless of teachers are prepared to teach in that language.
5. Tutors and trainees need to know how to make teaching and learning resources for reading from sustainable and easily accessible materials such as sacking, cardboard, seeds, raffia, bottle tops, manila paper and teach this to trainees. Writing and producing texts such as short stories as big books themselves will support them in understanding story structure. The production, management, use and storage of such materials would be also helpful.
6. Tutors need to know how to teach diagnostic, continuous and formative assessment of pupils in reading and to teach trainees how to intervene constructively when individual pupils' experience specific difficulties in learning how to read.

7.4.2 Specific issues related to teaching basic mathematics

7. The focus of ITE for training teachers to teach primary mathematics should be guided by the questions *what is that teachers actually do and how does it produce or hinder deep understanding of mathematics concepts from the perspective of learners?* The mechanistic approach observed in this research only addresses the first of these. An understanding of theory (propositional knowledge) as how one makes sense of practice is missing in the philosophy and practice of learning to teach mathematics in all six countries. Training for college mathematics not as mathematicians but as mathematics educators, which was seen to be lacking in all six countries might help address this issue.
8. The content of learning to teach primary mathematics should be grounded in teachers' content preparation in practice, with 'opportunities for learning the subject matter that would enable teachers not only to know but to use what they know in the varied contexts of practice' (Ball 2000 p 246). Teacher Education curriculum developers should reflect on how teacher educators, trainees and beginning teachers can be supported to make connections between teaching, learning materials and conceptual understanding. This should start with the intense study of school curriculum materials and what it means to understand the subject from the perspective of children in the classrooms of each country.
9. Clearly, trainees and NQTs have indicated from the survey that they find some basic mathematics topics more difficult to teach than others. These include: (a) Solving word problems in mathematics (b) Subtraction with re-grouping, (c) Length, Volume and Weight, (d) Division concept and (e) Comparing Fractions, These topics should be the focus of future CPD and ITE activities.

7.5 Possible areas for further research

The knowledge base of successful teaching in low income contexts is not sufficiently developed. Much research has concentrated on the deficiencies of teaching in low income countries and we therefore have accounts of poor practice and pupil failure. What we do not have are detailed descriptions of teachers' practice in contexts that are challenging. There is a need for research to seek out examples, to theorise them and to make them available as a resource for teacher education and policy-making. Easily available and relatively cheap video technology could make such examples available to tutors trainees and teachers.

There is the need for research which explores how TLMs can be used not simply to illustrate particular concepts, but in what context and appropriate conditions they can add value to concept development in mathematics for early grades. The ritualistic use of concrete objects and TLMs especially in classroom teaching suggests that teachers are losing a sense of their potential value in promoting deep understanding of concepts. Action research will be useful in exploring with teachers how pupils interpret their use and connect them with concepts. Appropriate strategies can then be developed to make them more a powerful source of promoting the understanding of basic concepts in mathematics.

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Appendix 1: Costs and Efficiency Analysis Method²⁰

$$\begin{aligned} \text{Trainee-Tutor Ratio} &= \text{TTR} = \frac{Nt}{NT} \\ \text{Where } Nt &= \text{number of trainees} \\ NT &= \text{number of tutors (lecturers)} \\ \text{Rearranging } Nt &= \text{TTR} \times NT \end{aligned}$$

Salary cost per trainee for teaching staff (Cs) is represented by

$$\text{Cost per trainee} = \text{CS} = \frac{\text{Sum of the Salary Cost of tutors}}{Nt} = \frac{\sum Ts}{Nt}$$

Where $\sum Ts$ = the sum of all tutors teaching English or Mathematics salaries

$$\text{By substitution } Cs = \frac{\sum Ts}{\text{TTR} \times NT}$$

If $\sum Ts$ is approximately equal to the Average of all the tutors teaching English (reading) or Mathematics (AvTs) x NT

$$\text{Then } Cs = \frac{\text{AvTs} \times NT}{\text{TTR} \times NT} = \frac{\text{AvTs}}{\text{TTR}}$$

Note:

- TTR is calculated when we know the number of tutors teaching the subject and the number of trainees he/she is teaching
- Recurrent teaching costs per trainee will rise with average tutors' salaries and fall as the TTR increases
- If AvTs is minimized and TTR maximized in ways consistent with maintaining quality, the economic concern with cost efficiency would be satisfied. However, this will depend on what is delivered to trainees in the TTC mathematics or English (reading) curriculum which will not only depend on salary costs per trainee, but would need to be translated into tutors contact hours with trainees (teaching reading or mathematics), and the work which surrounds these contact hours
- What is delivered in terms of taught time (taught hours per week or periods per week) for a particular cost, is a function of the number of trainees per tutor (TTR), the amount of teaching associated with the teaching posts and the average teaching group size.
- The formula for teaching load is $\frac{\text{Taught hours per week}}{\text{teaching group size}} \times \text{TTR}$

²⁰ Source: Lewin K (1999) Counting the Cost of Teacher Education: Cost and Quality Issues – MUSTER Discussion Paper, University of Sussex, Brighton