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DOES TEACHING METHODS AND AVAILABILITY OF TEACHING RESOURCES INFLUENCE PUPILS' PERFORMANCE?: EVIDENCE FROM FOUR DISTRICTS IN UGANDA



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ABSTRACT

This paper explores ways of improving education quality in Universal Primary Education (UPE) schools in Uganda. Following the introduction of UPE in Uganda in 1997, primary school enrolment increased tremendously, leading to a strain on existing teaching resources such as classrooms, teachers' accommodation, toilets, teachers, chalk, and students' furniture among others. The inadequacy of teaching resources partly attributes to the low quality of education in UPE schools as reflected in the Primary three and six pupils' performance in literacy and numeracy. Accordingly, Government responded by increasing supply of teaching resources with the hope of improving the quality of education in UPE schools.

The major findings of the paper include:

- i) Supplying more teaching resources in the current Uganda context should not be the number one priority intervention if the quality of education in public primary school is to be improved. Paradoxically, supply of teaching resources is found to have adverse effects on education quality. This suggests that the supply of teaching resources in these schools seem to be done at the expense of effective teaching.
- ii) Primary school teachers employ teacher-centred methods of teaching, which are less effective. The study finds that child-centred methods of teaching are more effective for both males and females as regards improvement of education quality. Yet, teachers in UPE schools hardly employ child-centred approaches to teaching, which mainly explains the poor quality of education in UPE schools.
- iii) There is urgent need for the ministry in charge of education to focus more on teacher supervision to compel teachers to attend to their duties and use child-centred methods of teaching. This calls for increased budget for school inspection and teacher supervision.

Key words

Teaching methods, teaching resources, pupil performance

ACRONYMS/ABBREVIATIONS

UPE	-	Universal Primary Education
PTA	-	Parent Teachers Associations
ESIP	-	Education Strategic Investment Plan
ESSP	-	Education Sector Strategic Plan
MOFPED	-	Ministry of Finance Planning and Economic Development
MoES	-	Ministry of Education and Sports
UNEB	-	Uganda National Examinations Board
PCR	-	Pupil classroom ratio
PTR	-	Pupil teacher ratio
SFG	-	School Facility Grant
PLE	-	Primary Leaving Examinations
EPRC	-	Economic Policy Research Centre
CSAE	-	Centre for the Study of African Economies
SMC	-	School Management Committee

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1.0 INTRODUCTION

Universal Primary Education (UPE) in Uganda was introduced in 1997 when government abolished school fees in government aided primary schools and stopped contributions to the Parent Teachers Associations (PTAs). Government prioritization of primary education was more explicitly stated in its Education Strategic Investment Plan (ESIP) (1997-2003) and its successor, the Education Sector Strategic Plan (ESSP) (2004-2015). These were developed on the premise that primary education has higher social returns compared to higher education. This, in turn, led to increased financing towards primary education with the share of primary education in the total education budget averaging to over 50 percent for the 13 years since UPE introduction (MoFPED 2009). As a result, investments were made in education and in particular to UPE programmes to match the increase in enrolment. More, especially, Government provided more education inputs such as additional teachers, classrooms, text books, staff houses and toilet facilities. Nonetheless, despite the increased supply of education inputs to primary schools, the quality of education in UPE schools has continued to decline (MoES 2008).

Uganda has made tremendous progress in increasing access to primary education. Enrolment rates increased from 16 percent in 1996 to 73 percent in 1997 and have increased at a rate of 5 percent every year since then (MoES 2008). Nonetheless, this has not been matched by a proportionate increase in education inputs in order for the government to meet the Millennium Development Goals (MDGs) two and three.¹ Indicators such as pupil-teacher ratio, pupil-classroom ratio and pupil-text book ratio are still below the government set targets. This could partly explain the declining quality in education outcomes as indicated by the Primary Leaving Examination (PLE) pass rates over time (UNEB 2009).

Several studies have tried to establish the relationship between inputs and pupil performance. Studies done by Riddell and Brown (1991) drew conclusions that teaching (resources availability and teaching methods) and not teachers was the critical factor.

Lockleed and Komenan (1989), Glewwe et al. (1991, 2008) supported the view that pedagogical processes were more significantly related to pupil achievements than were the physical and pedagogical input variables and school organization. Research done previously by Lezoflee and Brancroft (1995), Arrigada, (1981) emphasized regular assessment, working together in groups, giving pupils regular and timely feed back as key to pupil performance. For Uganda, Nanyonjo (2007) in her study on education inputs in Uganda found that inputs do matter, specifically inputs such as parent involvement in school environment and teacher characteristics played a great role in pupil learning achievements.

What is not clear, is the explanation for differences in education quality in UPE schools in different districts when the schools operate under similar policies and provision of education inputs. All UPE schools operate under the same policy. Specifically, tuition fees and PTA charges were abolished by government across the board. To this effect, government embarked on a very ambitious programme of increased supply of education inputs in all UPE schools.

¹MDG 2: Achieve universal primary education. Specifically, Target 2A: By 2015, all children can complete a full course of primary schooling, girls and boys.

MDG 3: Promote gender equality and empower women. Specifically, Target 3A: Eliminate gender disparity in primary and secondary education preferably by 2005, and at all levels by 2015.

However, pupil achievement in terms of numeracy and literacy differ across districts, and sometimes significantly. Unlike Nanyonjo's paper (2007) that focused more on primary six outcomes and various inputs, this paper focuses on teacher related inputs such as resource availability and methods to explain differences in pupil achievement in terms of numeracy and literacy.

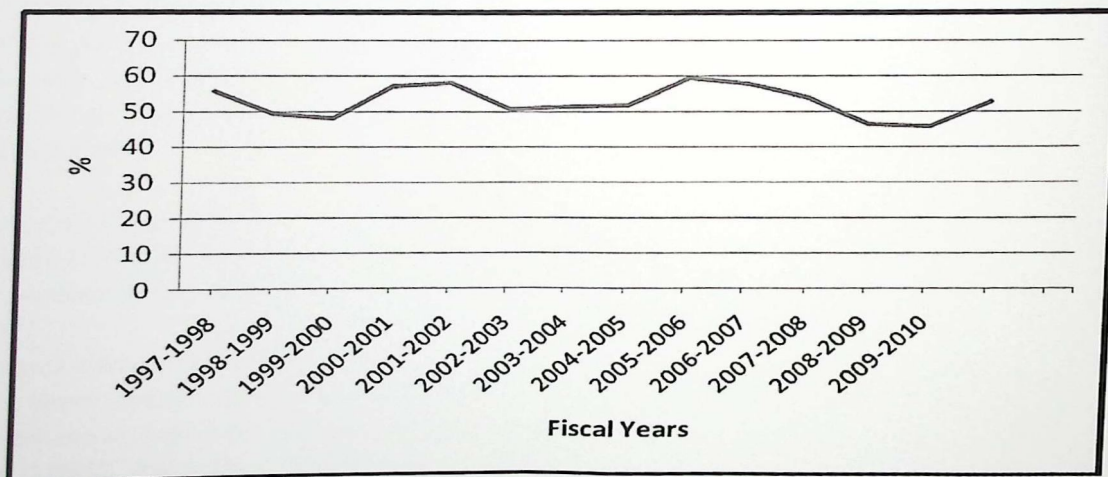
In this regard, the paper examines the effectiveness of these interventions against pupil performance using the National Assessment of Progress in Education (NAPE) tests in literacy and numeracy administered at primary three and primary six levels by the Uganda National Examinations Board (UNEb) in 2008. The paper specifically analyzes the link between education inputs, and teaching methods on the one hand, and pupil performance on the other. Using multi-level modelling methods, the paper investigates pupil's performance against teaching methods, and education inputs to establish the level of causality amongst the variables on pupil performance. Of course, there is a general understanding of variables that are likely to impact on pupil performance but empirical evidence of the quantitative effects of these interventions is limited and mixed in other countries.

2.0 UGANDA'S UPE SYSTEM AND PERFORMANCE TRENDS

2.1 UPE system

In 1986, the government initiated a review of the education sector with a view to making education more relevant to the development needs of the country and those of the learners. This process resulted in the government White Paper on Education of 1992. Upon his re-election as President of Uganda in 1996, H.E. Yoweri Museveni announced free primary education for the first four children per family. Difficulties in establishing eligibility criteria forced the government to abandon the 'four children ceiling' and extend free education to all school-going age children. But with UPE in place, government had to increase its budgetary allocations to primary education programmes. Thus, MoFPED (2009) data indicates that primary education programmes have, for over 13 years, taken over 50 percent of education sector budget expenditure allocations (**Figure 1**). Nonetheless, over the same time period, 83.6 percent, on average, of the total recurrent expenditure allocation in primary education have been spent on wages and 26.4 percent on non-wages. This implies that teaching materials, capitation grants and others have had a meagre allocation of the primary budget allocation.

Figure 1: Primary education expenditures in the total education sector budget, %



Source: MoFPED, 2009

The overall objective of the UPE policy was to increase access, equity and quality of primary education in Uganda with a view to eradicating illiteracy and subsequently transform society. The MoES, in its guidelines on policy, roles and responsibilities of stakeholders in the implementation of UPE (1998) gives the following specific objectives of the UPE programme:

- Establishing, providing and maintaining quality education as the basis for promoting necessary human resource development;
- Transforming society in a fundamental positive way;
- Providing the minimum facilities and resources needed to enable every child to enter and remain in school until the primary cycle of education is complete;

- Making basic education accessible to the learner and relevant to his or her needs as well as meeting national goals;
- Making education equitable in order to eliminate disparities and inequalities;
- Ensuring that education is affordable by the majority of Ugandans; and
- Fulfilling the government's mission to eradicate illiteracy and equip each individual with the basic skills and knowledge to exploit their environment for both self and national development.

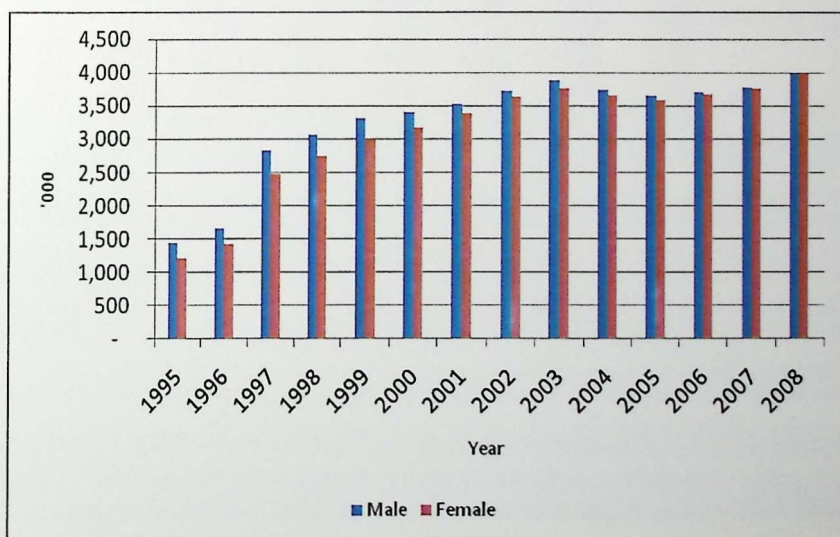
The first UPE objective mentioned above underscores provision of quality education, yet the UPE programme has continuously come under criticism for low quality education. In this regard, this study investigates the link between resources availability and teaching methods on the one hand, and education quality on the other in selected UPE schools in Uganda.

2.2 Situation analysis and UPE trends

i) *Enrolment's*

As earlier mentioned, since the introduction of UPE, primary education enrolments has been steadily on the increase; it doubled from 2.6 million pupils in 1995 to 5.3 million 1997 to 7.96 million in 2008 (Figure 2). With the increase in enrolment, there was improvement in the gender ratio between male and female pupils. In 2008, the enrolled number of female pupils almost equalled to that of males implying that government policy on achieving gender parity has been more or less achieved.

Figure 2: National pupil enrolment by sex: 1995-2008



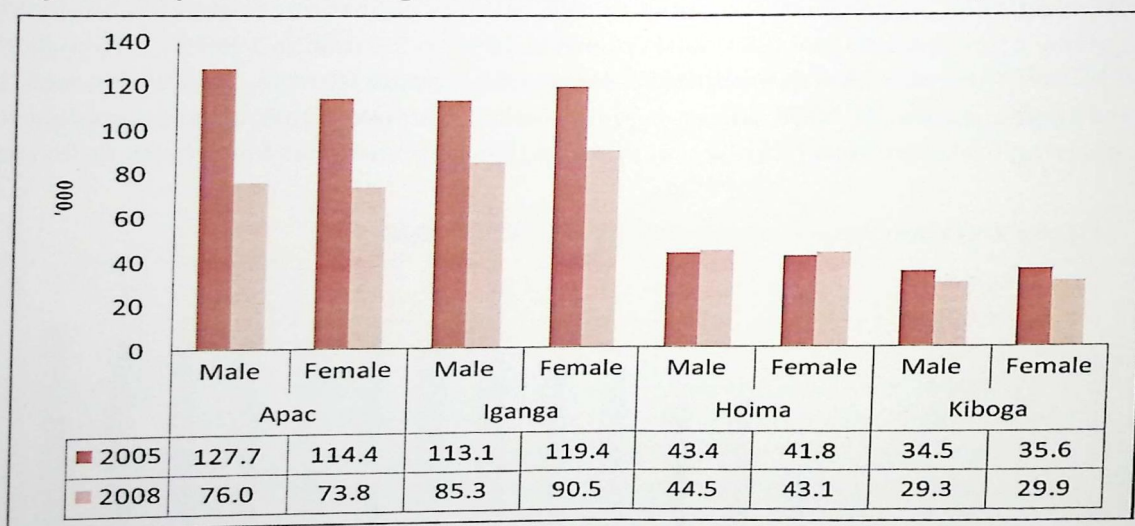
Source: MoES, Education Statistics Abstract (2008)

The paper focuses on four districts, namely, Apac, Iganga, Hoima and Kiboga. These were purposely selected with the intention of bringing out some of the challenges of low-performing schools in each of the four regions of Uganda. In each district, data were collected on 25 primary schools during the

baseline survey. A two-stage sampling procedure was used, first drawing a set of 5 sub-counties and then drawing 5 schools from within each of these. Weighting at each stage by the pupil population ensured that selected schools are statistically representative of rural school-going pupils.

This sub-section, therefore, presents a situational analysis of UPE performance in these districts. In 2005 and 2008, **Figure 3** indicates that for almost all the districts, enrolments were higher across categories in 2005 compared to 2008. Sections of Apac such as Oyam and Iganga districts were curved off in 2006 to create new districts, which explains decreases in enrolments in these districts for either of the sexes in 2008 (**Figure 3**). Another reason that could explain the reduction in enrolments in these districts is the parents' preference of private schools for their children (which are located mainly in urban centres) because of poor education quality in government UPE schools and generally dropout rates are high in the rural schools. Hoima district recorded marginal increase in primary school enrolment for both sexes from 2005 to 2008. On the other hand, Kiboga district recorded a decrease in primary school enrolment during the intervening period; school dropout is suspected to explain decreased enrolment in Kiboga district.

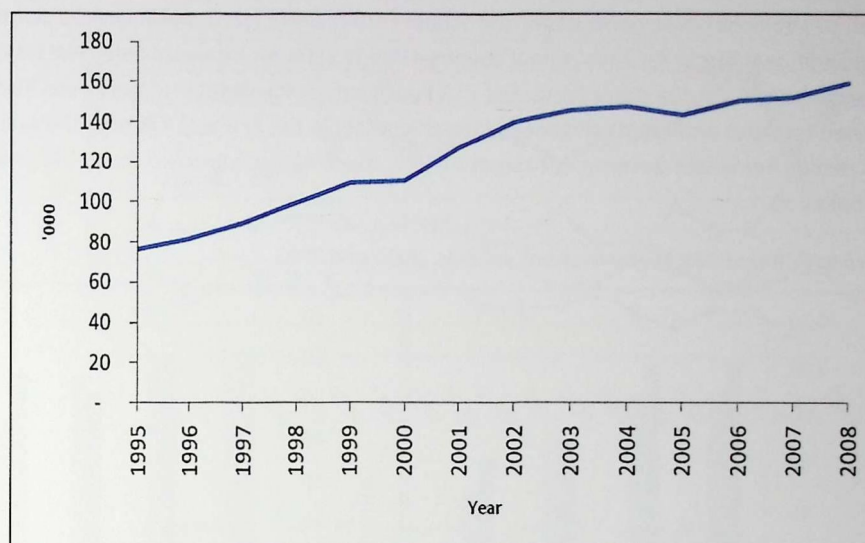
Figure 3: Pupil enrolment in government schools for selected districts by sex: 2005 & 2008



Source: MoES, Education Statistics Abstract (2005 and 2008)

ii) Teacher trends

With increasing number of pupil enrolments, government responded by increasing the number of primary teachers (**Figure 4**). Specifically, in 2001 and 2006, there was a decline in recruitment of teachers by Government. The decline in these years was partly attributed to inadequate funding to the education sector towards the wage and non-wage expenses. Besides, there was switching and re-allocation of government expenditure within the sectors. Nevertheless, the number of primary school teachers picked up thereafter. In 2008, 159,516 teachers had been registered to teach at primary level, a 50 percent increase from the 1997 level (**Figure 4**).

Figure 4: Total number of teachers, 1995-2008

Source: MoES, Education Statistics Abstract (2008)

Turning to the quality of teachers in primary schools, professionally trained teachers (teachers with a teaching qualification – teaching certificate or diploma) were about 66 percent of the total. Another category of primary teachers which is also competent enough to teach at primary school level comprised of holders of Ordinary level certificates (26.2 percent) and Advanced level certificates (3 percent). The composition of teachers in primary schools on the basis of their qualifications suggests that the explanation for poor education quality in UPE schools is not the lack of academically qualified teachers but could be due to lack of commitment from the teachers, inadequate competence skills reflected in disguised employment and high rates of absenteeism.

Table 1: Primary teachers for all school categorized by qualification and gender, 2008

Education level	Male (%)	Female (%)	Total
Primary	0.4	0.3	968
Primary + Cert./DIP	2.0	1.8	6,089
Ordinary level	15.5	10.7	41,812
Ordinary level + Cert./Dip	34.7	23.8	93,320
Advanced level	2.2	0.8	4,667
Advanced level + Cert./Dip	3.0	1.1	6,499
Graduate	1.0	0.4	2,127
Post Graduate Diploma	0.1	0.0	159
Masters Degree	0.0	0.0	92
Doctorate	0.0	0.0	23
Unknown	1.3	1.0	3,760
Total	60.2	39.8	159,516

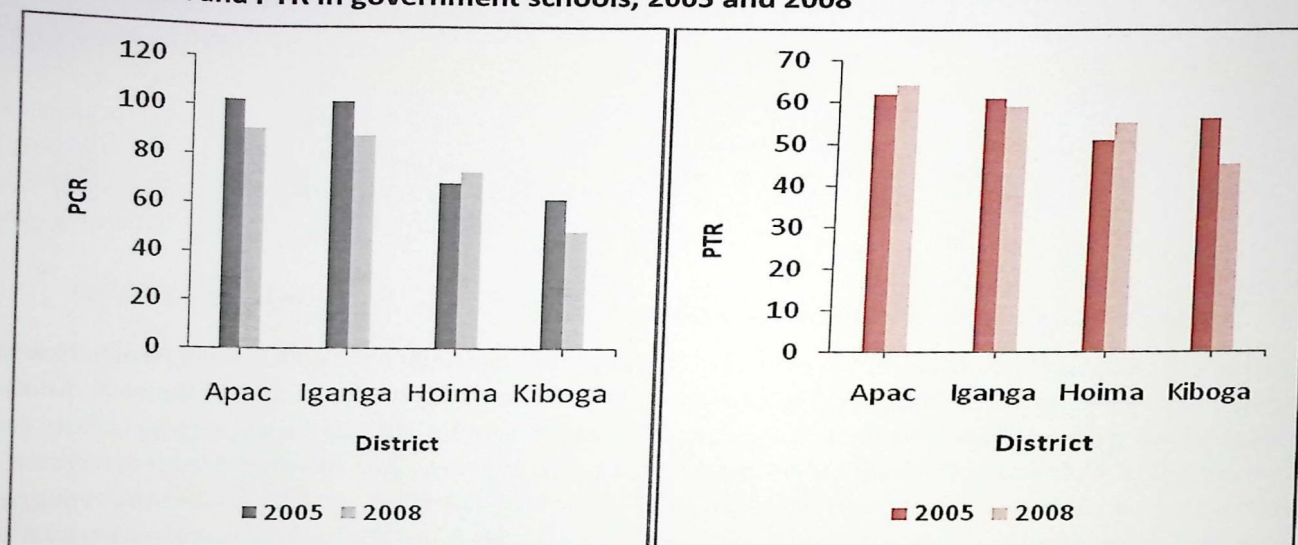
Source: MoES, Education Statistics Abstract (2008)

iii) Pupil classroom ratio (PCR), pupil teacher ratio (PTR) and pupil textbook ratio

Figure 5 shows PCR and PTR for 2005 and 2008 for government schools. PCR in government aided primary schools had considerably improved by 2008 for the four districts under consideration other

than Hoima which worsened from 69 in 2005 to 73 in 2008. Again the improvement in PCR was as a result of additional classrooms under the School Facility Grant (SFG), which enabled construction of two additional blocks for each school country-wide to cater for increased enrolments and hence reduce class sizes. On the other hand, the PTR improved for the districts of Iganga and Kiboga but worsened for Apac and Hoima (**Figure 5**). Improvements in the PCR and PTR notwithstanding, the ratios remain below the government target of 40:1, much higher compared to pre-UPE ratios that were below 30:1.

Figure 5: PCR and PTR in government schools, 2005 and 2008



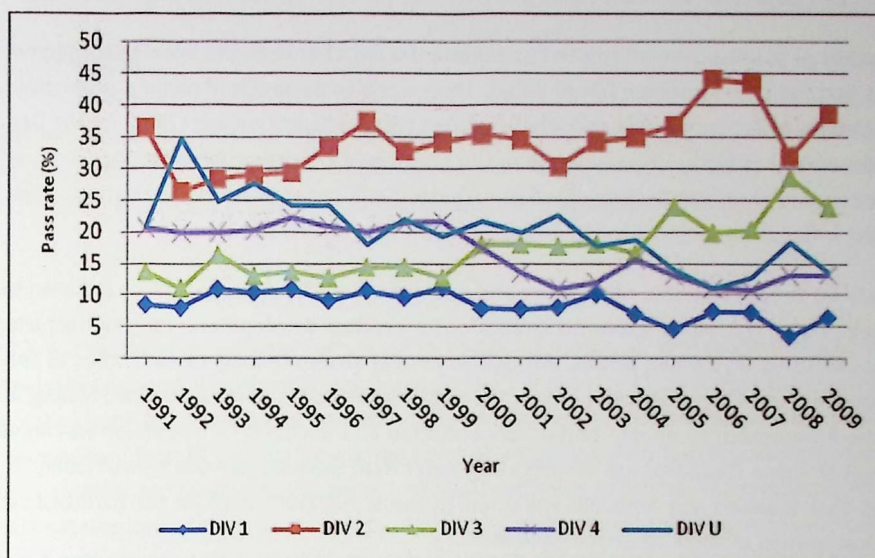
Source: Education Statistics Abstract, 2008.

There has been increasing scarcity of textbooks in primary school with worsening text book pupil ratio for all categories of textbooks. There was a notable increased scarcity for textbooks of key subjects, namely, English, Mathematics, Science, and Social Studies. From 2005 to 2008, the textbook: pupil ratio for primary seven worsened as follows: English from 19: 1 to 24: 1; Mathematics from 18: 1 to 26: 1; Science from 17:1 to 36:1 (MoES 2008).

iv) PLE performance

With regard to education quality, **Figure 6** shows that on the basis of grade category, education quality has been declining. The number of pupils passing in Division 1 has generally declined while the number in lower category (Divisions 2, 3, and 4) has increased for the 19 year period. Following the 1997 cohort, 10.64 percent passed in Division 1 and ten years later in 2007, only 7.21 percent passed in Division 1. Another example, in 2005 only 4.62 percent of pupils who sat for PLE passed in Division 1 compared to 10.11 percent in 2003 respectively. On the contrary, the proportion of persons passing in divisions 2, 3, increased from 30.1 percent and 18.0 percent in 2003 to 36.7 percent and 23.9 percent in 2005 respectively. In 2009, only 6.4 percent of the total number of pupils who sat in that year passed in Division 1. Simply put, the pass rates (as one of the measures of education quality) has declined since UPE programme was introduced especially in rural primary schools.

Figure 6: PLE performance by division: 1991-2009



Source: Uganda National Examinations Board (UNEB), 2009

Table 2: PLE performance by selected districts

	APAC					IGANGA				
Division	1992	1997	2007	2008	2009	1992	1997	2007	2008	2009
DIV 1	72	136	144	32	86	370	1,008	759	381	788
DIV 2	956	1,902	2,899	1,875	3,886	1,735	3,366	3,938	2,799	4,472
DIV 3	650	1,331	1,655	2,700	3,394	832	1,422	2,813	3,820	3,836
DIV 4	1,282	2,225	1,210	1,289	1,841	1,507	1,993	1,630	1,941	2,454
DIV U	3,268	2,001	1,352	1,966	1,172	3,276	1,844	2,996	4,465	3,628
	HOIMA					KIBOGA				
Division	1992	1997	2007	2008	2009	1992	1997	2007	2008	2009
DIV 1	49	130	497	253	414	33	110	62	20	77
DIV 2	421	766	3,168	2,398	3,179	229	519	1,254	754	1,302
DIV 3	229	326	1,152	2,167	1,791	128	240	994	1,207	1,160
DIV 4	473	484	467	840	838	237	349	661	710	874
DIV U	983	823	534	1,168	887	386	225	1,016	1,540	950

Note: Div U – indicates failure

Source: UNEB, 2009

Table 2 generally the pass rates increased across the four districts with Iganga district recording more passes as compared to Kiboga district that recorded the least. Besides, the major increases in the pass rates across the four districts were recorded in Divisions two and three respectively. In Apac district, the number of pupils failing (Division U) declined from 3,268 in 1992 to 1,172 in 2009. On the other hand, in Hoima district, failures declined from 983 to 887 in between the period 1992 – 2009. The fluctuations in some of the figures were attributed to curving off of some districts to create new ones.

3.0 LITERATURE REVIEW

A number of studies have attempted to explore the links between the learning environment of the pupils and their performance (Wolff 2002). There are also a number of national qualitative research case studies including those conducted by Price Water House Coopers (2000) for the Department for Education and Skills, United Kingdom; the Ministry of Education, New Zealand (2004); and some related examples in Architecture of Schools (Dudeck 2000), that relate to pupil learning achievements and the influencing factors like the teaching methods and school resources.

A study on the UK National Curriculum and its implications for space and place has been evaluated (Dudek 2000). This study explored strategies for reading development, ranging from whole-class groups focusing on a white board, through to smaller groups reading to each other, to one-on-one sessions, either in the classroom or in a separate reading room. It recommended reading niches off the main classroom to enable better concentration and audibility. A concession was noted in this study that space standards are 40 percent greater than the norm for this type of facility. The study noted that teachers are uniquely equipped to throw enlightenment on the particular social and physical context of their classroom spaces.

In another study by Castillow (2004), it was noted that pedagogical principles are pure, pristine, and packed with pedagogical power. With their generic nature, they can be applied to a wide variety of circumstances. For example, learning is facilitated when the instructor demonstrates what is to be learned rather than merely telling what is to be learned. Pedagogical principles are also very pragmatic, in that they synthesize a rich set of practical, instructional experiences and can be used to deal with new practical problems.

Grimmitt (2000) takes the concept of pedagogical principles and school resources to a very abstract level, defining them as substantive hypotheses and facilitation about teaching and learning of the pupils. In particular, pedagogical principles and strategies, facilitate the process of devising better learning practices which, in turn, determine how pupils will experience, engage with and respond to content. This stimulates better learning outcomes. Ideally, learning and teaching better practices should first be expressed in generic terms and then in terms specific to the actual learning environment. Thus, the teaching and/or learning 'strategies' are the more concrete actions designed to implement pedagogical principles and thereby fulfil or contribute to stated aims of better school performance.

It is noted that better teaching and learning practices are influenced greatly by national, cultural and contextual circumstances (Sosniak 2005). Kubanek-German (2003a) observes that teaching practices/methods are changing within a complex process of enduring educational innovation, itself due to societal change. Change occurs through a democratic dialogue or is enforced. The rationales for such methods change over time. During periods of Innovation, teaching principles are refined and adapted based on experience. This occurs through the perception of day-to-day viability and the influence of the market, competition between authorities, research, parents and new societal developments such as ICT.

Actual counts of textbooks in Uganda also revealed significant influence on pupil achievement (Heyneman and Jamison 1980). The research indicated a moderate effect of textbooks and instructional material on achievement. In Malaysia, Beebout (1972) and in Chile (Schiefelbein and Farrell 1973), respectively, found that textbook availability was related to higher achievement.

4.0 METHODS AND DATA

4.1 The model

In education economics, much of the empirical literature is based explicitly or implicitly, on the theoretical concept of an educational production function. Using the terminology from Cooper and Cohn (1997), an educational production set can be described as expressed in Eq. (1)

$$(1) \quad F(y, x) \leq C$$

Where y is a vector of educational outputs, x a vector of inputs, C is a positive scalar, while F represents the educational technology which transforms x into y . Eq. (1) describes the combinations of education inputs and outputs that are technically possible and transformable, i.e. the production set. The maximum level of outputs for a given level of inputs is called the educational production function or frontier and represents the set of technically efficient solutions. The production function approach operates by assuming that a variety of inputs (such as educational resources and teaching/mentoring methods) are transformed by the school into an output such as standardized test scores. With this in mind, the main method employed in estimating such relationships in this paper is the regression technique (Anna et al. 2000), which is parametric in nature. This technique is used to estimate 'average statistical behaviour' where the regression coefficients are regarded as average weights or coefficients from a weighted model (Cooper and Cohn 1997; Mayston and Jesson 1999).

However, in this paper context, the regression methodology has some theoretical and empirical shortcomings. The endogeneity problem² is the major drawback and it is at the root of a number of theoretical and empirical critiques in this field of education economics (Mayston 1996). For example, Mayston (1996) argues that most educational production function models focus exclusively on the supply side (i.e. the simple link between inputs and outputs), ignoring the fact that, the level of resources experienced by a child can be endogenously determined if schools undertake optimising behaviour.³ However, there are possible remedies documented in the existing education literature, value-added models (Anna et al. 2000); estimating saturated models with interaction (Dearden et al. 1997; Figlio 1999, Wright et al. 1997); and using multi-level modelling (Goldstein 1987, 1995).

Thus, this study has adopted multi-level modelling because of its prime advantage over other methods. The approach recognizes the inherently hierarchical structure of an education system. This enables one to comment on the factors influencing performance at the different levels within the education system. Generally, results show that multi-level models and OLS models yield similar results when there is low correlation between pupil outcomes within groups/categories (Goldstein 1987, 1995). It can be shown that in a two stage model (e.g. resources and teaching methods or reading and numeracy), as the intra-unit correlation increases, the OLS estimator will increasingly underestimate the true standard error.

Therefore, the model used in this study has three levels of analysis whereby the first and second levels (as expressed in Eq (2) and Eq (3) respectively) deal exclusively with teaching methods and

²The regression assumes that the schools inputs will via some educational technology translate into outputs. In effect, such a relationship may to some extent mask the causation between school inputs and outputs

class resources. However, in order to cater for the endogeneity problem, the third level (as expressed in Eq (4)) is then estimated where both the teaching methods and class resources are combined or pooled together.

$$(2) \quad TS_{ij} = \beta_0 + \beta_{nj}M_{nj} + \varepsilon$$

$$(3) \quad TS_{ij} = \alpha_0 + \alpha_{kj}R_{kj} + \varepsilon$$

$$(4) \quad TS_{ij} = \gamma_0 + \beta_{nj}M_{nj} + \beta_{kj}R_{kj} + \varepsilon$$

Where;

Outcome (TS_{ij}) = test scores for pupil i^{th} in the j^{th} class

M_{nj} = vector of teaching methods on pupils in the j^{th} class

R_{kj} = vector of teaching resources on pupils in the j^{th} class

ε = vector of errors of pupils, teaching methods and resources

Additional models controlling for gender were generated for each of the general three models stated above. In addition, to estimate the model, STATA 11 analytical package was used. But first, descriptive statistics for each data set were undertaken. The two data sets, one on pupil standardized tests, and the second on individual level teacher data, were merged prior to estimations.

4.2 Data

This paper utilises the baseline survey data collected under the three-year collaborative Education Project between the Economic Policy Research Centre (EPRC), Uganda and the Centre for the Study of African Economies (CSAE), University of Oxford, United Kingdom. The baseline survey was conducted in 2008 with support from the Uganda Bureau of Statistics (UBoS). The survey was conducted between July to August, 2008 in the districts of Apac, Iganga, Hoima and Kiboga. These districts were chosen for national and regional representation and in terms of performance in the national PLE conducted annually for primary seven (P7) pupils. In each district, 25 schools were randomly sampled bringing the total to 100. Specifically, only schools in a rural setting and government aided were sampled in order to control for heterogeneity. Information was gathered at school level, and at individual level. The individual level data collected included that on head teachers, teachers, parents and School Management Committee (SMC) members. However, this paper mainly draws from the information gathered on teachers.

The teacher questionnaire gathered information on class size, teacher characteristics such as teacher's age, gender, years of teaching, qualification, distance of residence from school, tenure within school. Methods of teaching such as frequency of tests, homework, checking class work, pupils working in groups, use of textbooks in classroom, visual aids were also captured. The teaching resources that were available at the time of the interview such as chalk, desks, wall charts, homework assignments, textbooks and chairs were recorded.

In each of the sampled district, about 20 pupils for primary three (P3) and about 20 pupils for P6 sat for the standardized NAPE assessment tests – and in turn derived the test scores.

³ The school will systematically allocate resources to each child, such that the learning output of the whole school is maximised.

These tests were administered by the UNEB. Specifically, about 2,000 P3 pupils and about 2,000 P6 pupils sat for the tests in Literacy and Numeracy in August 2008.

4.3 Description of model variables

This sub-section presents a description of the model variables used in Eq. (2)-(3).

Outcomes (TS_{ij}) refers to the actual result or effort of the i^{th} pupil in the j^{th} class (sometimes referred to as achievement or assessment). In this paper the outcome measure is NAPE results in literacy and numeracy scored pupils in primary 3 and primary 6 in 2008.

Teaching methods (M_n) refers to the different styles or modes a teacher uses to make the pupils in the j^{th} class understand the subject matter. Simply put, what a teacher does while in class teaching. In this paper the methods considered include: writing on the notice board; explaining and reading while the pupils listen; demonstrations; a teacher dealing with a pupil one on one, among others (Table 3).

Teaching resources (R_x) refers to the materials or inputs available in class to a teacher on that particular day he or she is conducting a lesson in the j^{th} class. The resources considered include: chairs, chalk, textbooks, desks, tests, wall charts, and homework assignments, among others (Table 3).

The random sample was based on rural schools within each district. Five schools were selected from randomly selected five sub-counties in each district.

Table 3: Variables definition and description

Variable category	Variable	Description
Pedagogy	Do you teach Math/English to the pupils	Yes =1 and '0' otherwise
	Number of Math/English textbooks available in class during lesson hours	Total number of textbooks if the subject(s) was taught to multiple classes
	Number of desks available for use during lessons hours	
	Number of chairs available for use during lessons hours	
	Availability of chalk during lesson hours	Yes =1 and '0' otherwise
	Number of wall charts available to the class room	This refers to the classroom where a subject is being taught
	Number of in class tests given to each pupil during the previous term	This refers to the first term of the year 2008
	Number of homework assignments set and marked per pupil during the previous term	This refers to the first term of the year 2008
Teaching methods	Explain & read without pupils re-peating	1=Yes, method used and '0' otherwise
	Writing on board	1=Yes, method used and '0' otherwise
	Rote learning, drill: students repeat	1=Yes, method used and '0' otherwise
	Pupils read aloud, one by one	1=Yes, method used and '0' otherwise
	Self-study: Pupils read in silence	1=Yes, method used and '0' otherwise
	Partition class-group discussions	1=Yes, method used and '0' otherwise
	Discuss interactively with the pupils	1=Yes, method used and '0' otherwise
	Question and answer	1=Yes, method used and '0' otherwise
	Child centred method	1=Yes, method used and '0' otherwise
	Teacher demonstration	1=Yes, method used and '0' otherwise

Source: EPRC-CSAE Education Project: Baseline survey dataset, 2008

5.0 RESULTS AND DISCUSSION

This section presents and discusses the findings starting with the descriptive results prior to the regression results.

5.1 Descriptive results

The results in **Table 4**, indicate that most of the teachers tend to stay in close vicinity to the school. Teachers, on average, reside within less than 2 km distance from the schools where they teach. Notably, in Apac district, the majority (60.8 percent) of the teachers stay in less than 1 km distance from the schools as compared to 42.0 percent of the teachers who travel more than 6 km to reach the schools where they teach in Iganga. Having teachers' close to the school has been a policy promoted by the government as a way of improving teaching and learning standards in public primary schools. During the survey, School Management Committee (SMC) members interviewed pointed out that the rate of teacher absenteeism and teachers coming late to schools was partly attributed to long distances some teachers travel. Besides, the means of transport used by the teachers is less affordable and inconveniencing to them.

It is worth noting that the upgrading of the teachers has been progressive. There is a noticeably small proportion of licensed and grade II teachers in the primary education system in Uganda. The government's in-service training was introduced for purposes of encouraging less qualified teachers to upgrade while still in active teaching service. Furthermore, **Table 4** indicates that the majority of the primary teachers are in Grade III and Grade V (diploma holders). And Apac (37.0 percent) and Iganga (34.0 percent) districts registered the majority of grade V teachers, while grade III teachers have been evenly distributed across the four districts. Yet, the districts of Hoima and Kiboga have noticeable numbers of few licensed and highly untrained teachers.

Table 4: Descriptive statistics of some of the teachers' socio-demographic variables, %

			District		Gender			
	Apac	Hoima	Iganga	Kiboga	Male	Female	Cases	Total
Distance (km) of home from school								
<1	60.8	17.0	6.4	15.8	72.5	27.5	171	100
1 - 2	4.2	29.4	38.5	28.0	56.3	43.8	144	100
3 - 4	10.8	30.8	32.3	26.2	80.0	20.0	65	100
5 - 6	4.4	24.4	35.6	35.6	77.8	22.2	45	100
>6	4.0	32.0	42.0	22.0	80.0	20.0	50	100
Highest qualification								
Graduate Teacher	25.0	0.0	50.0	25.0	75.0	25.0	4	100
Grade V	37.0	18.0	34.0	11.0	62.0	38.0	100	100
Grade IV	20.0	0.0	60.0	20.0	100.0	0.0	5	100
Grade III	24.9	27.9	24.6	22.7	71.3	28.7	331	100
Grade II	0.0	20.0	40.0	40.0	80.0	20.0	5	100
Licensed Teacher	0.0	27.3	0.0	72.7	72.7	27.3	11	100
Other	0.0	46.4	7.1	46.4	46.4	53.6	18	100
Years of teaching experience								
<6	13.6	31.8	20.1	34.4	66.9	33.1	154	100
6 - 10	27.8	23.7	25.4	23.1	68.6	31.4	169	100
11 - 15	28.7	23.0	33.3	14.9	70.1	29.9	87	100
>15	43.1	15.4	32.3	9.2	80.0	20.0	65	100
All	25.5	25.1	26.1	23.4	69.9	30.1	475	100
Valid cases	121	118	124	111	332	143	475	

Note: Years of experience refers to years of employment on both full and part-time teaching service.

Source: EPRC-CSAE Education Project: Baseline survey data, 2008.

Teaching experience is vital to school performance and studies, for example, Riddel and Brown (1991) and Glewwe et al. (1991, 2008) have shown that there is always a significant positive correlation between years of teaching experience and pupil performance in primary schools. Our results reveal that the majority of the teachers across the four districts have teaching experiences of about ten years or more – this is a good indicator of teacher quality by any standards. To the contrary however, using results of the UNEB, Heyneman (1976), Silvey, (1972) and Somerset, (1968) found that very little evidence existed on the effectiveness of in-service teacher training programmes; teachers' years of schooling in both primary and post primary; and teacher training in boosting teaching skills leading to higher student achievements.

With regard to teaching resources, Iganga district had the highest number of resources across the sampled districts (Table 5). However, this seems not to have translated into good grades as Table 6 indicates.

Table 5: Descriptive summary statistics of resource variables used in the models

Variable (Number)	Apac	Hoima	Iganga	Kiboga
Number available for use in class during lessons:				
- Math textbooks	24	12	26	8
- English textbooks	22	10	19	11
- Desks	14	17	17	14
- Chairs	2	2	3	1
- Wall charts	5	5	4	7
Class tests given to each pupil during the previous term (first term, 2008)	5	4	7	9
Homework assignments set and marked per pupil during the previous term (first term, 2008)	8	29	9	21

Source: EPRC-CSAE Education Project: Baseline survey data, 2008.

More specifically, **Table 6** indicates the mean scores of numeracy and literacy of the pupils based on the NAPE test at the time of conducting the baseline survey in 2008. The results revealed that although Iganga district has most of the well qualified teachers and more teaching resources, the actual outcomes indicate a reverse trend. Simply put, NAPE results actually indicate that Iganga district trails the other districts in performance outcomes in both literacy and numeracy for primary 3 and primary 6 levels. Instead, Hoima district which has fewer qualified teachers yields better outcomes in literacy and numeracy among female and male pupils for both primary 3 and primary 6 respectively. Poor performance in Iganga district could be attributed to limited adequate supervision by the inspectors and lack of staff houses near schools, which compels most teachers to travel long distances (average of 7.3km) to the school of operation. Kiboga district has better performance outcomes in numeracy for primary 6 pupils. Kiboga's better performance is somewhat surprising and the question is why and how?

Table 6: Mean numeracy and Literacy scores by district and level, 2008

	Apac		Hoima		Iganga		Kiboga	
	Numeracy	Literacy	Numeracy	Literacy	Numeracy	Literacy	Numeracy	Literacy
Primary three								
Female	16.0	13.5	22.7	18.9	11.3	9.9	20.8	17.6
Male	17.5	14.2	23.5	17.8	12.1	10.5	21.7	18.2
All	16.8	13.9	23.1	18.3	11.7	10.2	21.3	17.9
Primary six								
Female	22.7	15.2	27.5	23.9	16.5	13.9	30.5	23.4
Male	27.1	17.0	29.4	24.0	20.5	14.1	32.5	23.7
All	25.0	16.2	28.4	23.9	18.5	14.0	31.5	23.5

Note: Primary 3 results were graded out of 50 and out of 100 for Primary 6.

Source: EPRC-CSAE Education Project: Baseline survey data, 2008.

The results in (Table 7) suggest that most teaching methods significantly impact on the pupils' performance in both literacy and numeracy at primary 3 and primary 6 level. However, "Writing on the board" was found to be insignificant for numeracy achievement in both classes. The result is negatively significant for literacy at primary 6. Similarly, rote learning was only significant for literacy for primary 3 and insignificant for numeracy both at primary 3 and 6, and for literacy in primary 6. These two methods, which in education terms are broadly described as teacher-centred methods of teaching, were found to be dominantly used in primary schools. Wide application of these teaching methods that are hardly significant in terms of promoting pupil achievement in terms of numeracy and literacy partly explains poor education quality in UPE schools.

Table 7: Results of teaching methods on pupil performance ⁵

Variable	Primary three		Primary six	
	Numeracy	Literacy	Numeracy	Literacy
Explain & read without pupils repeating	3.09*** (0.25)	2.04*** (0.20)	1.01*** (0.35)	0.99*** (0.33)
Writing on board	0.26 (0.29)	-0.26 (0.24)	0.12 (0.41)	-1.11*** (0.39)
Rote learning, drill: students repeat	0.57 (0.61)	1.36*** (0.50)	0.37 (0.85)	0.01 (0.82)
Pupils read aloud, one by one	2.61** (1.03)	2.69*** (0.84)	4.31*** (1.35)	0.60 (1.24)
Self-study: Pupils read in silence	8.69*** (1.12)	5.65*** (0.92)	9.72*** (1.71)	7.34*** (1.58)
Partition class-group discussions	3.47*** (0.37)	1.71*** (0.30)	1.90*** (0.53)	1.04** (0.49)
Question and answer	3.82*** (1.36)	4.10*** (1.11)	13.63*** (1.82)	8.65*** (1.68)
Child centred method	14.17*** (1.43)	7.95*** (1.18)	16.69*** (2.02)	10.07*** (1.87)
Teacher demonstration	7.73*** (1.63)	4.69*** (1.35)	6.25*** (2.23)	2.56 (0.06)
Other	-3.73*** (1.08)	-3.54*** (0.88)	-7.04*** (1.47)	-3.29** (1.35)
Constant	16.61*** (0.17)	14.08*** (0.14)	24.66*** (0.23)	18.78*** (0.22)

Notes: Standard errors in the parenthesis ***p<0.01, **p<0.05, *p<0.1, the base category is discuss interactively with the pupils' methods

Source: EPRC-CSAE Education Project: Baseline survey data, 2008

Table 7 gives modelling results for different teaching methods and their impact on numeracy and literacy achievements on pupils in primary 3 and primary 6. The estimation reveals that teacher-centred methods (writing on board, and rote learning drill) lead to different achievement results compared to when teachers apply pupil-centred methods such as group work, question and answer, and pupils reading in silence.

Results further indicate that child centred methods seemed to have had the highest effect on pupil performance with a coefficient of 14.17 ($p=0.00$) and 16.69 ($p=0.00$) at numeracy level for P3 and P6 respectively. Child-centred methods, which were found effective both in P6 and P3 and for both numeracy and literacy are: partition class into discussion groups; question and answer; self-study – pupils read in silence; pupils reading aloud – one by one; and teacher demonstration. These teaching methods though more effective compared to teacher-centred methods are rarely used by teachers in classroom teaching.

That said, the results in (**Table 7**) suggest that most teaching methods significantly impact on the pupils' performance in both literacy and numeracy at primary 3 and primary 6 level. However, "Writing on the board" was found to be insignificant for numeracy achievement in both classes. The result is negatively significant for literacy at primary 6. Similarly, rote learning was only significant for literacy for primary 3 and insignificant for numeracy both at primary 3 and 6, and for literacy in primary 6. These two methods, which in education terms are broadly described as teacher-centred methods of teaching, were found to be dominantly used in primary schools. Wide application of these teaching methods that are hardly significant in terms of promoting pupil achievement in terms of numeracy and literacy partly explains poor education quality in UPE schools.

Table 7 suggests that, all the methods identified and studied are critical to better learning outcomes, but their effectiveness differ. This suggests that teachers should apply a variety of methods. Castilow (2004) demonstrates that how the teaching techniques are applied is very important because teaching methods are purely pristine, and packed with pedagogical power that is generic in nature. The author further asserts that the techniques can be applied to a wide variety of circumstances. For example, learning is facilitated when the instructor demonstrates what is to be learned rather than merely telling what is to be learned. In the Ugandan context, and in practice, there seems to be limited application of child-centred methods, which require a lot of preparation on the part of the teacher.

Inadequate preparation of teachers to teach is revealed by limited use of charts, prepared notes, group discussion(s), question and answer, and other pupil-centred approaches to teaching. With ineffective supervision of teachers, primary school teachers seem to have opted for the easier to use teacher-centred teaching methods, which are less effective. Plausibly, inadequate teacher supervision mainly explains persistent use of the easier teacher-centred methods of teaching. This suggests improving supervision of teachers to compel them to employ the ore effective child-centred methods of teaching to improve performance of pupils.

⁵ Analysis controlled for district but results generated were so mixed that district as a variable was dropped.

Moreover, in support of the findings, elsewhere in the World, Tisher (1970), while working in eighth grade class-rooms in Queensland in Australia investigated verbal interaction in science classes and its association with pupils' understanding in science. Only nine classes were studied and the student, not the classroom, was used as the unit of analysis. The findings suggested that gains in pupils' understanding in science were associated with the level of cognitive demands made by the teachers and the warmth exhibited by the teacher. Allen (1969) from a study in Victoria of mathematics classrooms in the infant school also reported significant findings associated with the warmth of teacher-pupil relationships. Banerjee et al. (2004) recently conducted a randomized evaluation of a computer-assisted learning programme in India and found much more positive results than those from the computer-assisted learning programme in Israel (Angrist and Lavy 2002).

From **Table A1**, as with the general model on teaching methods on pupil performance, disaggregating it further produced similar results. Writing on the board for numeracy, though significant and positive for females at P3, was either insignificant or negative for males. Generally, teacher centred methods had at least an impact on females relative to their male counterparts but on the overall, child-centred methods of teaching had a more significant impact across levels irrespective of gender but more so for males than females.

5.2.2 Teaching resources and pupil performance

Estimates of the second model (**Table 8**), of outcomes, as a function of teaching resources, gave somewhat surprising but explainable results. It is expected that, the availability of instructional materials (class resources, chalk, wall charts and writing board) provides motivating conditions for pupil learning achievements than limited access to them. This is especially true for countries in which the level of school resources is already high. One should, on the other hand, expect the relationship between resources and outcomes to be much clearer for developing countries as the low initial level of resources makes it more likely than additional inputs to have a significant effect. In this paper, the results, though significant, had signs which do not agree with theory other than desks for literacy at P6 and numeracy at both P3 and P6 (**Table 8**).

Table 8: Results of teaching resources on pupil performance ⁶

	Literacy		Numeracy	
	P3	P6	P3	P6
	Coef.	Coef.	Coef.	Coef.
English /Math Textbks	-0.003	-0.029***	-0.028***	-0.040***
	(0.006)	(0.010)	(0.004)	(0.005)
Desks	-0.061***	0.044**	0.028*	0.060***
	(0.011)	(0.020)	(0.015)	(0.023)
Chairs	-0.304***	-0.347	-0.098***	-0.227***
	(0.036)	(0.054)	(0.028)	(0.038)
Chalk	-2.750**	-7.647	0.024	-4.874
	(1.198)	(2.817)	(1.508)	(3.111)
Wall Charts	-0.007***	-0.004	-0.008***	-0.011***
	(0.002)	(0.003)	(0.002)	(0.003)
Tests	-0.028***	-0.019***	-0.005**	-0.007**
	(0.003)	(0.005)	(0.002)	(0.003)
Homework assignment	0.027***	0.023***	-0.001	0.003
	(0.003)	(0.005)	(0.002)	(0.003)
Constant	20.544***	28.502***	20.833***	32.682***
	(1.189)	(2.814)	(1.503)	(3.117)

Notes: Standard errors in the parenthesis *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, the base category is discuss interactively with the pupils' methods

Source: EPRC-CSAE Education Project: Baseline survey data, 2008

The availability of textbooks, for example, had a negative significant effect on numeracy both in classes and literacy in P6. Similarly, supply of charts (by the Ministry of Education and Sports) had negative and significant impact on numeracy both in classes and on literacy for P3. Also, supply of tests (mainly from district education authorities) had significant negative effect on both literacy and numeracy in both classes. Even the supply of chalk is found to be negatively significant in terms of affecting numeracy in both classes and literacy in P3. These surprising findings suggest that Government seems to have got wrong the priorities in primary education from the perspective of improving the quality of education in UPE schools.

⁶ Analysis controlled for district but results generated were so mixed that district as a variable was dropped.

Results indicate and support theory (see for example, Glewee et al. 1991) on underscoring the relationship between inputs with outcomes/performance. In plain terms, the results indicate that exposing textbooks to pupils discourage them from performing better, which is contrary to theory and practice. One possible explanation could be that exposing pupils to textbooks may not be sufficient enough to facilitate learning but rather effective use of these resources is critical to learning (Clarke 1994). It is also argued that, if the pupils have desks they perform better especially in numeracy. And that the wall charts that are mainly used by the teachers and less by pupils during teaching lead to poor pupil performance. Besides giving pupil home assignments facilitates better learning outcomes for both reading and numeracy.

However, there are exceptions as regards the importance of supply of teaching resources in the improvement of education quality. The supply of desks was found to be positively significant in improving literacy in both classes and also numeracy in P6. Similarly, the supply of homework was found to be positively significant in the improvement of literacy in both classes, and had the expected positive effect in numeracy for both classes.

The above findings are somewhat supported by some authors and differ with others. According to the works of Hanushek (2003, pf.84), it was observed that, there was somewhat stronger support for the expected positive relationship between inputs and achievement. Fuller and Clarke (1994) also reinforced this conclusion by taking into account the cross-counting differences in socio-economic and cultural settings even within developing countries. The results of this paper suggest the contrary, largely due to the fact that some materials though exist, may not directly be used by pupils per say. Further disaggregating the above results by gender (**Table A2**), results indicate that disaggregating data by gender did not change results, either. Again, text books and tests had negative significant signs, which is contrary to theory. Chairs and wall charts did not create positive change in pupil performance across genders. This could be attributed to the rare use of wall charts, tests, textbooks and chairs in rural UPE schools. Homework assignments were more significant at literacy level across class and gender but not for numeracy. With regard to desks, these had a negative significant effect for females and males at P3 for literacy. Interestingly enough, desks had a positive significant effect for males at P3 numeracy and P6 numeracy and literacy but did not play a significant role for females. In the Ugandan context, Government has focussed mainly on the provision of teaching resources with a view to improving education quality. Unfortunately, the provision of teaching resources seem not to have been adequately matched with measures that would ensure that teachers use appropriate child-centred methods to teach, which rendered the teaching resources less effective. For example, provision of more teaching resources does not ensure that teachers attend to all their lessons and teach effectively. Teacher performance in the classroom can only be assured when there is an effective system of supervision of teacher's attendance to their duties and their performance in classrooms.

The challenge facing UPE is the sequencing between the supply of education inputs or resources on the one hand, and measures to ensure that teachers attend to their duties and teach effectively employing child-centred approaches to teaching, on the other. The above findings that teaching resources impact on pupil achievement adversely should be correctly interpreted that the supply of teaching resources in Uganda have run ahead of teacher supervision. Indeed, teaching resources still remain inadequate - but more should be supplied only with additional interventions to make sure

that teachers attend to their duties and teach effectively, employing a variety of teaching methods, especially child-centred approaches.

While remaining cognizant of the fact that most of the primary schools including the teachers have been constrained with the teaching materials, child-centred methods of teaching requires more time and experienced teachers. Teachers in UPE schools commit insufficient time to their work, especially in preparation to teach. Yet, application of child-centred methods of teaching call for adequate preparation, beyond having a scheme of work to lesson planning including preparation of notes, charts, demonstrations, and well thought-out exercises for pupils. Without an effective system of teacher supervision, teachers have opted for the easier teacher-centred approaches as and when they go to class to teach.

5.2.3 Pooled model estimates

Table 9 (also **Table A3**) provides the combined model results, general and by gender respectively, which largely reveal similar findings. On teaching methods, the finding that teacher centred approaches to teaching are in general less effective compared to child-centred approaches is maintained. Second, the combined model shows that a variety of teaching methods is necessary for more effective teaching.

On supply of teaching resources, apart from desks, the supply of teaching resources is not the number one priority in terms of interventions. Centrally supplied charts, chalk, and textbooks seem to have failed to cause the desired improvement in education quality mainly on account of inadequate attention to ensuring that teachers attend to their duties and teach effectively.

The model results further show that, while controlling for class teaching resources, most of the teaching methods facilitate or improve outcomes in both numeracy and literacy in P3 than in P6 respectively. It can be observed that teacher demonstration, pupils reading aloud (one by one), interactive discussions and dividing pupils into discussion groups are some of the major effective teaching methods for lower primary classes.

As far as teaching class materials are concerned, desks or sitting furniture has been found to be positively significantly input; other inputs seem to be at saturation in the present circumstances. However, home assignments too are positively significant in terms of improving education quality. It is noteworthy, however, that homework assignment depend on the seriousness and commitment of teachers, whom, if left unsupervised, may not give homework assignments in adequate quantity.

Table 9: The complete model estimates and results ⁷

Variable	P3		P6	
	Numeracy	Literacy	Numeracy	Literacy
	Coef.	Coef.	Coef.	Coef.
Explain & read without pupils repeating	2.22*** (0.37)	2.05*** (0.29)	-1.40*** (0.54)	0.91* (0.50)
Writing on board	0.21 (0.42)	0.01 (0.36)	-1.27** (0.64)	-0.71 (0.66)
Rote learning, drill: students repeat	-3.38*** (0.97)	0.22 (0.78)	-3.27** (1.43)	-2.17 (1.56)
Pupils read aloud, one by one	4.48*** (1.37)	1.49 (1.70)	5.25*** (1.80)	6.56** (2.86)
Self-study: Pupils read in silence	5.90*** (1.29)	3.48*** (1.04)	7.43*** (2.15)	4.41** (2.01)
Partition class-group discussions	2.97*** (0.50)	2.68*** (0.46)	-0.60 (0.74)	1.41* (0.85)
Question & Answer	2.49 (2.95)	-8.62*** (1.90)	18.72*** (4.14)	3.05 (2.39)
Child centred method	13.72*** (2.34)	-6.56*** (1.95)	10.84*** (3.35)	dropped
Teacher Demonstration	14.08*** (2.58)	dropped	7.03* (3.64)	1.01 (3.44)
Other	-7.95*** (2.11)	7.71*** (1.68)	-5.92** (2.96)	2.97 (1.97)
English/Maths Text books	-0.03*** (0.004)	0.001 (0.006)	-0.04*** (0.01)	-0.02** (0.01)
Desks	0.03* (0.02)	-0.06*** (0.01)	0.06*** (0.02)	0.04** (0.02)
Chairs	-0.11*** (0.03)	-0.30*** (0.036)	-0.21*** (0.04)	-0.32*** (0.06)
Chalk	-1.10 (1.49)	-2.60** (1.20)	-4.37 (3.10)	-7.02** (2.90)
Wall Charts	-0.01*** (0.002)	-0.01*** (0.002)	-0.01*** (0.003)	-0.01* (0.003)
Tests	-0.006** (0.002)	-0.03*** (0.004)	-0.01* (0.003)	-0.02*** (0.01)
Homework assignment	-0.0005 (0.0019)	0.03*** (0.004)	0.002 (0.003)	0.02*** (0.01)
Constant	20.70*** (1.49)	19.20 (1.22)	32.63*** (3.09)	27.23*** (2.93)

Notes: Standard errors in the parenthesis ***p<0.01, **p<0.05, *p<0.1, the base category is discuss interactively with the pupils' methods

Source: EPRC-CSAE Education Project: Baseline survey data, 2008

⁷ Analysis controlled for district but results generated were so mixed that district as a variable was dropped.

6.0 CONCLUSION AND IMPLICATIONS FOR POLICY

Enrolment at primary school has been increasing over time since the introduction of UPE in 1997, implying that government has achieved enrolment target levels. However, completion rates have not matched the high enrolments in comparison to the number of pupils who sat PLE for the 2007 cohort. In addition, education quality has declined over time, raising concerns within the MoES on what strategic interventions to be put in place to achieve the first pillar of UPE policy. Government's view on this matter was to supply more teaching resources.

There is a clear effect of teaching methods on pupil achievement in terms of numeracy and literacy. Child-centred methods of teaching are found to be more effective compared to teacher-centred teaching methods. Unfortunately, teachers in UPE schools tend to employ more of teacher-centred methods, which render their teaching less effective. Preference for teacher-centred methods of teaching might be explained by the fact that they do require much preparation on the part of the teacher.

On the other hand, child-centred methods that are more effective require a lot of input by the teacher in terms of time for preparation - preparation of charts, notes, demonstrations, questions, and group work, among others, take a lot of teacher's time. Consequently, teachers tend to apply two broad teaching methods in UPE schools, namely: writing on the board; and rote learning or drill, which, this paper finds to be less effective in terms of making students acquire numeracy as well as literacy skills at P6 and P3. When not effectively supervised, teachers will ordinarily opt for the easy way out - using teacher centred approaches. The use of teacher centred approaches, which is less effective in terms of imparting numeracy and literacy skills in pupils, partly explains the poor quality of education in UPE schools.

Turning to supply of teaching resources, the paper has revealed that the supply of teaching resources has faster moved compared to interventions that would ensure that teachers attend to their duties and teach effectively. Consequently, supply of more teaching resources in all the four districts failed to cause the expected impact on education quality. On the contrary, the findings from the model reveal an adverse impact on education quality of supply of more textbooks, chalk, and wall charts etc. This suggests that Government needs to rework its priorities in terms of interventions to improve quality of education in UPE schools. The issue is more about sequencing the supply of teaching resources and balancing it with the measures that would improve teacher performance in the class room.

Again, on the matter of teaching resources, the paper finds that despite the good indicators of teacher qualifications and proximity to school, Iganga district has had poor performance at PLE for a long time and for emphasis performed poorly in the NAPE literacy and numeracy examinations administered in 2008 compared to Hoima district, which had relatively weaker input indicators. Iganga district had the highest number of teachers (42 percent) compared to Hoima (32 percent). More importantly, a relatively good number of teachers across districts have Grade V and Grade III qualifications more so for Iganga and Apac districts. In addition, most teachers in Apac have teaching experience of more than 15 years, though many teachers across districts had teaching experience of 11-15 years. Nonetheless, education quality in UPE schools across these districts remains wanting.

This study would not be complete without a word on Government's preference for supply of teaching resources and inadequate attention on supervision of teachers to compel them to use more child-centred approaches to teaching for more effectiveness. It is clear from the paper that if Government is to improve education quality in UPE schools, it should focus more on supervision of teachers. If the budget for supervision of teachers is not available, Government would do better even by redistributing the budget for supply of teaching resources and find some money for supervision of teachers. The system of teacher supervision needs a review with a view to compelling teachers to use child-centred approaches to teaching and less of teacher centred approaches.

The art of balancing the budget for teacher supervision, on the one hand, and supply of teaching resources, on the other, is a tenacious one. Supply of teaching resources in Uganda is centrally done while supervision of teachers is a decentralized function to the districts. This would call for reviewing the way the education budget is shared between the Central Government and the districts or local governments with the intention of increasing funding to local governments to enable them effectively inspect schools and supervise teachers' attendance to duty.

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Table A1: Teaching methods on pupil performance by class and gender

	Female						Male					
	P3			P6			P3			P6		
	Numeracy	Literacy	Coef.	Numeracy	Literacy	Coef.	Numeracy	Literacy	Coef.	Numeracy	Literacy	Coef.
Variable												
Explain & read without pupils repeating	3.455***	2.093***	Coef.	1.365***	1.716***	Coef.	2.684***	1.971***	Coef.	0.625	0.189	Coef.
	(0.364)	(0.305)		(0.485)	(0.457)		(0.338)	(0.273)		(0.517)	(0.481)	
Writing on board	0.836**	0.064		0.780	-0.542		-0.300	-0.566*		-0.127	-1.201**	
	(0.418)	(0.064)		(0.572)	(0.542)		(0.389)	(0.316)		(0.604)	(0.562)	
Rote learning, drill: Students Repeat	1.835**	2.571***		1.534	1.051		-0.607	0.267		-0.424	-0.397	
	(0.900)	(0.754)		(1.223)	(1.205)		(0.835)	(0.675)		(1.181)	(1.127)	
Pupils read aloud, one by one	3.186**	2.454**		6.982***	2.488		2.136	3.018**		1.981	-1.052	
	(1.418)	(1.188)		(1.713)	(1.599)		(1.491)	(1.200)		(2.102)	(1.922)	
Self-study: Pupils read in silence	10.032***	6.814***		14.474***	10.552***		7.478***	4.676***		7.002**	4.897*	
	(1.684)	(1.412)		(2.317)	(2.163)		(1.491)	(1.200)		(2.917)	(2.668)	
Partition class-group discussions	3.217***	1.342***		2.028***	1.928***		3.591***	2.004***		1.738**	0.235	
	(0.543)	(0.455)		(0.718)	(0.679)		(0.496)	(0.404)		(0.789)	(0.731)	
Question and answer	1.569	4.592***		13.946***	7.344***		6.655***	3.405**		12.419***	9.899***	
	(1.828)	(1.537)		(2.396)	(2.237)		(2.026)	(1.631)		(2.779)	(2.542)	
Child centred method	12.297***	9.190***		15.757***	9.679***		16.359***	6.748***		17.326***	10.606***	
	(2.060)	(1.726)		(2.575)	(2.404)		(2.044)	(1.660)		(3.140)	(2.872)	
Teacher demonstration	5.911**	4.184**		5.461*	1.523		10.061***	4.850**		2.788	1.981	
	(2.340)	(1.961)		(2.915)	(2.722)		(2.321)	(1.898)		(3.562)	(3.258)	
Other	-1.538	-3.737***		-6.608***	-2.040		-6.407***	-3.142**		-6.263***	-4.138*	
	(1.418)	(1.188)		(1.831)	(1.710)		(1.658)	(1.335)		(2.336)	(2.137)	
Constant	15.665***	13.822***		22.629***	17.827***		17.498***	14.324***		26.141***	19.198***	
	(0.242)	(0.203)		(0.332)	(0.311)		(0.231)	(0.188)		(0.342)	(0.315)	

Notes: Standard errors in the parenthesis ***p<0.01, **p<0.05, *p<0.1, the base category is discuss interactively with the pupils' methods

Source: EPRC-CSAE Education Project: Baseline survey data, 2008

Table A2: Teaching resources availability on pupil performance by class and gender

Variable	Female				Male			
	P3		P6		P3		P6	
	Literacy Coef.	Numeracy Coef.	Literacy Coef.	Numeracy Coef.	Literacy Coef.	Numeracy Coef.	Literacy Coef.	Numeracy Coef.
English/Maths Textbks	-0.001 (0.009)	-0.024*** (0.005)	-0.033*** (0.014)	-0.039*** (0.007)	-0.002 (0.008)	-0.031*** (0.005)	-0.023 (0.156)	-0.039*** (0.007)
Desks	-0.077*** (0.017)	0.000 (0.023)	-0.023 (0.029)	-0.008 (0.033)	-0.046*** (0.015)	0.046** (0.020)	0.089*** (0.028)	0.086*** (0.031)
Chairs	-0.273*** (0.053)	-0.058 (0.039)	-0.380*** (0.075)	-0.226*** (0.052)	-0.312*** (0.050)	-0.12*** (0.039)	-0.313*** (0.081)	-0.225*** (0.056)
Chalk	-2.409 (1.954)	-3.196 (2.582)	-5.417 (3.801)	-5.344 (4.477)	-3.044** (1.510)	2.112 (1.841)	-7.492 (6.446)	-3.496 (4.502)
Wall Charts	-0.008*** (0.002)	-0.009*** (0.003)	-0.005 (0.004)	-0.008*** (0.004)	-0.007*** (0.002)	-0.007** (0.003)	-0.003 (0.004)	-0.014*** (0.004)
Tests	-0.043*** (0.012)	-0.045*** (0.012)	-0.045*** (0.019)	-0.049*** (0.015)	-0.036*** (0.124)	-0.018 (0.011)	-0.039* (0.020)	-0.034** (0.016)
Home work assignment	0.026*** (0.005)	-0.002 (0.003)	0.026*** (0.007)	0.003 (0.004)	0.025*** (0.005)	-0.002 (0.003)	0.018** (0.008)	0.002 (0.004)
Constant	20.599*** (1.942)	23.926*** (2.573)	27.244*** (3.800)	32.961*** (4.488)	20.589*** (1.499)	19.244*** (1.835)	27.449*** (6.445)	32.220*** (4.510)
	R=4%	R=3%	R=3%	R=4%	R=3%	R=3%	R=2%	R=4%

Notes: Standard errors in the parenthesis ***p<0.01, **p<0.05, *p<0.1, the base category is discuss interactively with the pupils' methods

Source: EPRC-CSAE Education Project: Baseline survey data, 2008

Table A 3: Complete model estimates by class and gender

	Female						Male					
	P3			P6			P3			P6		
	Numeracy	Literacy		Numeracy	Literacy		Numeracy	Literacy		Numeracy	Literacy	
Variable	Coef.	Coef.		Coef.	Coef.		Coef.	Coef.		Coef.	Coef.	
Explain & read without pupils repeating	3.075*** (0.558)	2.128*** (0.434)		-0.545 (0.764)	1.387* (0.706)		1.208** (0.505)	1.829*** (0.389)		-1.823*** (0.813)	0.168 (0.752)	
Writing on board	1.409*** (0.636)	0.300 (0.542)		0.414 (0.899)	0.151 (0.902)		-1.047* (0.561)	-0.326 (0.474)		-1.926*** (0.954)	-0.891 (0.991)	
Rote learning, drill: Students Repeat	-2.555* (1.447)	1.509 (1.180)		-2.629 (2.030)	-3.399 (2.359)		-4.467*** (1.296)	-1.097 (1.042)		-3.448* (1.997)	-1.277 (2.102)	
Pupils read aloud, one by one	4.838*** (1.891)	3.178 (2.198)		8.038*** (2.211)	7.596*** (3.415)		4.139* (1.985)	-1.675 (2.776)		2.815 (2.975)	4.360 (4.935)	
Self-study: Pupils read in silence	6.964*** (1.890)	5.807*** (1.671)		11.200*** (2.659)	7.102*** (3.126)		4.807*** (1.764)	1.835 (1.316)		3.605 (3.501)	3.382 (3.179)	
Partition class-group discussions	3.048*** (0.765)	2.814*** (0.706)		0.396 (1.008)	2.129* (1.135)		2.926*** (0.660)	2.477*** (0.620)		-0.674 (1.101)	0.959 (1.346)	
Question and answer	2.954 (4.040)	-7.212*** (2.750)		19.630*** (5.184)	1.572 (3.884)		1.287 (4.646)	(omitted)		16.357*** (6.927)	4.848 (3.621)	
Child centred method	12.362*** (3.041)	-5.985*** (3.020)		8.000*** (3.935)	1.551 (4.216)		13.924*** (3.955)	2.646 (1.748)		14.297*** (6.026)	(omitted)	
Teacher demonstration	14.904*** (3.487)	(omitted)		3.658 (4.459)	(omitted)		12.559*** (4.207)	9.998*** (2.640)		4.308 (6.562)	-1.196 (6.097)	
Other	-7.197*** (2.567)	6.447*** (2.458)		-3.542 (3.408)	3.386 (3.377)		-8.135*** (3.757)	-1.154 (1.330)		-6.292 (5.508)	2.556 (3.058)	
English/Maths Textbooks	-0.022*** (0.005)	0.000 (0.009)		-0.040*** (0.007)	-0.023 (0.015)		-0.028*** (0.005)	0.003 (0.008)		-0.037*** (0.008)	-0.019 (0.016)	

Variable	Female				Male			
	P3		P6		P3		P6	
	Numeracy Coef.	Literacy Coef.	Numeracy Coef.	Literacy Coef.	Numeracy Coef.	Literacy Coef.	Numeracy Coef.	Literacy Coef.
Desks	(0.005) 0.005	(0.005) -0.068***	(0.007) -0.010	(0.015) -0.030	(0.005) 0.044**	(0.008) -0.044***	(0.008) 0.085***	(0.016) 0.085***
Chairs	(0.023) -0.080**	(0.018) -0.257***	(0.034) -0.206***	(0.030) -0.336***	(0.020) -0.123***	(0.015) -0.316***	(0.032) -0.206***	(0.029) -0.292***
Chalk	(0.039) -4.141	(0.054) -2.195	(0.052) -5.653	(0.077) -4.618	(0.039) 1.029	(0.051) -2.955**	(0.056) -2.663	(0.083) -6.895
Wall Charts	(2.548) -0.007***	(1.962) -0.010***	(4.444) -0.008**	(3.899) -0.007*	(1.819) -0.007**	(1.520) -0.009***	(4.496) -0.015***	(6.535) -0.004
Tests	(0.003) -0.045***	(0.002) -0.038***	(0.004) -0.049***	(0.004) -0.043**	(0.003) -0.026**	(0.002) -0.034***	(0.004) -0.036**	(0.004) -0.038*
Home work assignment	(0.012) -0.001	(0.012) 0.023***	(0.015) 0.002	(0.019) 0.022***	(0.011) -0.002	(0.012) 0.024***	(0.016) 0.002	(0.021) 0.016**
Constant	(0.003) 23.072***	(0.005) 19.032***	(0.003) 32.973***	(0.007) 25.444***	(0.003) 19.755***	(0.005) 19.518***	(0.004) 32.241***	(0.008) 26.637***
	(2.551)	(1.983)	(4.433)	(3.948)	(1.819)	(1.545)	(4.483)	(6.566)
	R=7%	R=6%	R=7%	R=4%	R=7%	R=6%	R=6%	R=3%

Notes: Standard errors in the parenthesis ***p<0.01, **p<0.05, *p<0.1, the base category is discuss interactively with the pupils' methods

Source: EPRC-CSAE Education Project: Baseline survey data, 2008

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