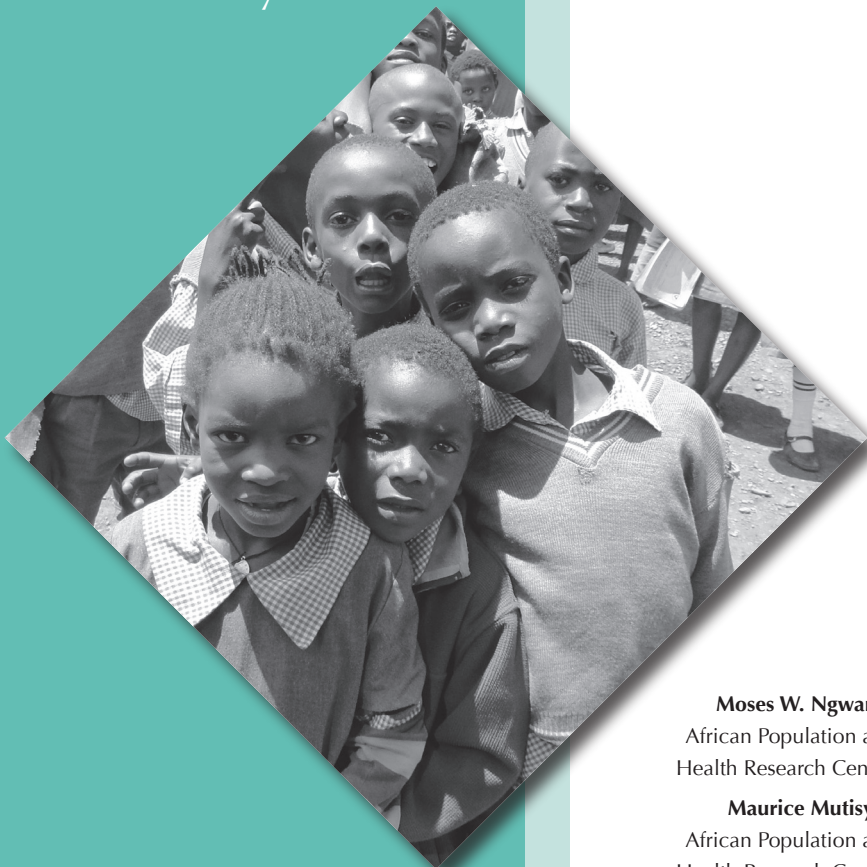


# Patterns of teaching style and active teaching: Do they differ across subjects in low and high performing primary schools in Kenya?

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# Abstract

The deteriorating quality of education in low income sub-Saharan Africa countries is of particular concern following the successful implementation of universal primary education policies in the 1990s. The problem is that the dominant voices and the few research on matters of quality in Africa tend to focus on inputs, outputs and outcomes, and very little is researched and written on processes. Yet, logically, understanding the process variables is essential in determining the mechanism by which inputs are transformed into both positive and negative outputs and outcomes. Kenya presents this problem in its 'natural' form whereby within the same locality, there are state schools that persistently perform well and others that persistently perform poorly in standardized national examination league tables. What accounts for this persistent and consistent difference is less known, and yet, herein may lie the answer of what works to improve learning for majority of pupils.

This paper, which focuses on the patterns of teaching styles and active teaching across subjects and between low and high performing schools, is an attempt to search into what accounts for differences in performance between schools which are within the same locality. It uses data collected in 72 primary schools spread across 6 districts. We use video recordings of 213 lessons in Math (72), Science (71) and English (70) and interviews with subject teachers in Kenyan primary schools to generate evidence on patterns of teaching styles and active teaching. Results show that teaching practice across subjects is inclined towards the command and task styles that do not promote critical thinking among learners. The dominant teaching activity was individual seat work in Math lessons; recitation in English lessons; and whole class chorus in Science lessons. Overall, active teaching accounted for 62% of the lesson time. The one way ANOVA results show insignificant variation between subjects and school category on active teaching, and therefore this may not be the source of differential performance between low and high performing schools.

## **Key words:**

Teaching styles, active teaching, Math, Science, English, primary school

# 1. Introduction

According to Muska Mosston, a guru of teaching styles and classroom practices, the anatomy of teaching style is made up of planning, execution and evaluation decisions (Garuccio, 2004). Garuccio posits that no one teaching style is superlative for every classroom teaching situation. Smith (2009) supports this view when he argues that learners have dominant learning styles and therefore it is upon the teacher to establish and use a teaching style that takes care of the learning needs of the learners. Smith outlines four distinctive learning styles including auditory, visual, kinesthetic and sequential. According to Garuccio, an effective teacher is that who uses a variety of styles depending on the learners' entry behaviour and circumstances surrounding the lesson.

Furthermore a teacher is more likely to use styles or a combination of styles that suits his or her strengths in instructional delivery. Literature on teaching calls for teachers to be creative and improvisational. For instance Scot, Callahan and Urquhart (2009) emphasize the need of having classrooms that are less teacher-scripted and less teacher command if learners are to co-construct knowledge and avoid knowledge growth stunting. Reilly, Lilly, Bramwell and Kronish (2011) support this view when they assert that teachers must be creative with their content knowledge and pedagogical skills when instructing learners with a diverse academic and social background. In Canada, Reilly, et al found teachers teaching style to be student-centered and promoted student inclusivity and interest during instruction.

In Kenya, public debate on the quality of education indicates that there is growing interest and concern about what actually happens in the classroom since the Government successfully implemented free primary education (FPE) policy in 2003. Teachers may be well trained and yet effective learning still fails to take place. Schools are under pressure from the parents and communities to show good results at the end of primary cycle examination, as good results will enable the children to transit to better secondary schools. Ironically within the same locality, there are schools that persistently perform poorly in national examinations, while others persistently perform well. In this paper we provide an opportunity to inform this debate and understand whether teaching styles and active teaching across subjects differ, and what teacher and school characteristics may account for this difference. We examine the extent to which the observed teaching styles and active teaching differ across subjects, schools and whether such differences explain the differential performance between low and high performing schools in Kenya's KCPE league table. We also examine the extent



to which teaching styles and active teaching are related to individual teacher and school characteristics including opportunity to learn. The rest of the paper is organized as follows: Section 2 scans the internal literature and identifies the gaps and conceptually positions the paper. Section 3 presents the methods and data within which the teaching styles were observed and analysed. Section 4 presents the findings and their discussion in relation to literature. Section 5 contains the conclusion and the implication of the findings to education policy.

## 2.Literature and gaps

Research evidence has shown that an important aspect of quality education is the teaching process that goes on in the classrooms. For example in Belgium, a study by Opdenakker and Damme (2006) observed that the quality of teaching, time on task and content covered are promising explanatory variables of educational effectiveness, among other classroom based variables. The study concluded that a pupil-centered instructional style has a positive effect on the learning support teacher give to learners during instruction, and to the quality of interaction between the teacher and the learners. According to Aitkin and Zuzovsky (1994) and Wentzel (2002), teaching styles and teaching behavior mediate teacher influence on learning and explain differences in student learning outcomes. But despite the importance of the teaching practices in explaining differences in learning outcomes, as indicated in these studies, Opdenakker and Damme (2006) laments that little research has been done on the degree to which classroom practices are class, teacher, and school dependent, on one hand, and are correlated to pupil composition, teacher attributes and teaching technique on the other.

Not all teacher attributes have an influence on how teachers teach. For instance, in Belgium, teacher's gender did not matter in classroom practices, suggesting that male and female teachers taught the same way (Opdenakker & Damme, 2006). The study further found that teachers with higher job satisfaction gave more instructional support to their class, and this can be a source of difference in academic performance between schools.

The amount of time spent on a learning task is highly correlated with learning gains. For example, a randomized control trial in South Africa, involving the use of computer aided instruction to cover the math curriculum, showed significant improvement in math performance among the treatment group even with modest time spent using the computer aided instruction (Louw, Muller & Tredoux, 2008). In Spain, a study by Ruiz-Gallardo, Castano, Gomez-Aldy and Valdes (2011) found that problem-based learning and cooperative learning used by teachers during instruction significantly and positively influenced student performance. The authors argued that these approaches aided knowledge assimilation and hence higher performance in the exams.

In Nigeria, Hardman, Abd-Kadir and Smith (2008) found the dominance of teacher explanation, recitation and rote learning in classroom discourse with little emphasis on pupil understanding. In this study that involved three subjects – Math, English and Science - teacher-centered, lecture-driven pedagogy was popular among teachers across the three primary school subjects. The study also found few follow-up moves meant to encourage or



motivate the learner after giving a verbal response to a task or during Q-A sessions. This lack of encouraging follow-up moves was found to discourage learners from being active participants in the class.

In Kenya, we identified two relevant studies – Hardman, et al (2009) and Ackers and Hardman (2001). Hardman et al. (2009), study investigated the impact of a school-based pedagogical teacher training program on teaching practice. The study found that compared to the baseline performance (see Ackers & Hardman, 2001), there was greater utilization of group work with improved teacher-pupil interactions during whole class teaching. The study further found that such practices were more common among teachers who had undergone a school-based in-service training on pedagogical skills. Compared to baseline, teachers were also found to plan better, utilize teaching resources and had improved classroom management practices. In a more recent study, Ngware, et al (2010) found that group work was hardly utilized during math instruction, and the few lessons that attempted to use did not succeed in group work because students sat in groups but worked individually.

## 2.1 Conceptual issues

In any teaching and learning interaction, a set of decisions must be made – either deliberately or by default. Such decisions can be grouped into three sets (see Ashworth 1992; Garuccio, 2004): pre-impact – decisions that define the intent of the lesson as contained in the lesson preparations and planning; impact – this refers to the decision related to execution of the instructions; and post-impact – include decisions on assessment or evaluation of the lesson objectives. In this paper, we view teaching style as a set of decisions made in line with teaching norms and aimed at causing pre-defined learning outcomes.

Over the last four decades researchers in education have identified specific teaching styles and related them to the philosophy of teaching and student learning. Most notable is the work of Mosston (1966) (cited in Ashworth, 1992; Mueller & Mueller, 1992) that defined a spectrum of teaching styles and behaviours based on the interactions and decision-making roles between the teacher and students during instruction. The work of Mosston has been developed into a continuum that provides possible options of interactions between teacher and learner based on the extent to which the teacher or learner assumes responsibility of lesson activities (see for example Ashworth, 1992; McCullick & Byra, 2002; Byra, 2002). On one side of the continuum are the teaching styles where the teacher dominates the teaching process with the learner being a recipient or making few or no decisions. These styles include command, practice/task style, reciprocal style, self-check and inclusion styles (see for example Garuccio, 2004; Ashworth, 1992; Mueller & Mueller, 1992; McCullick & Byra, 2002; Byra, 2002). The basic thinking capacity reflected within this cluster of styles is one of reproducing known knowledge, replicate models, recall information and practice skills. On the other side of the continuum is the more open-ended and student-centred style where the teacher acts only as a facilitator. Styles on this side include guided discovery, divergent



discovery, learner-designed individual program, learner-initiated and self teaching/problem solving. These styles form the cluster that promotes production (or discovery) of new knowledge. According to Chatoupis, (2010) the line between the two clusters is the discovery threshold that identifies the cognitive borders of each cluster.

Every teacher has his or her dominant and preferred teaching style though most often a blend of aspects of different styles are adopted to make teaching more effective. The choice of style can be influenced by beliefs about what constitutes good teaching, student backgrounds, preferences, abilities, and the norms of their particular discipline, individual attributes and working environment (Byra, 2002). Previous analysis of data from our study identified three dominant teaching styles that we described as: (1) Recitation that was characterised by teacher asking questions or guiding the process with individuals or whole class chorus being the order of response. This is similar to command style in Mosston's spectrum; (2) Individual seat work – similar to practice or task style where students carry out teacher-prescribed tasks as the teacher goes round the classroom correcting or assisting individual learners; and (3) Whole class instructions that was characterised by lecture, demonstrations and reviews with the teacher making almost all decisions – the learners were passive (Ngware, et al 2010). Under the Mosston spectrum, this style resembles the command style, as in the previous style, only that in this case learners were only listening and/or taking notes.

In all the teaching styles mentioned, pupil-teacher interactions are important to maximize learning. In education literature, this is referred to as active teaching – that is, use of strategies that maximise opportunities for interaction. Within each of the teaching styles observed in the three subjects, we described active teaching to include aspects or activities within the style where opportunities for teacher-pupil direct interactions are enhanced. Table 1 presents all the activities within a lesson that we identified as enhancing active teaching, and were measured in minutes indicating how long the activity took within a lesson.

**Table 1: Activities identified to involve active teaching**

Item No	Teaching style	Specific teaching activity
Q10d	Individual seat work	Teacher checking work Individual (working)
Q10e	Individual seat work	Teacher checking work Individual (stopped)
Q11a	Recitation	Q_A: Individual learner (Teacher asks)
Q11d	Recitation	Q_A: Individual learner (Learner asks)
Q12g	Whole class	Teacher checking -work group (working)
Q12h	Whole class	Teacher checking -work group (stopped)
Q13a	Whole class	Whole class task instructions (Teacher only)
Q13b	Whole class	Whole class demonstrations (Teacher only)
Q13c	Whole class	Whole class lecture (Teacher only)
Q13d	Whole class	Whole class review/Recap (Teacher only)
Q13e	Whole class	Whole class evaluate lesson (Teacher only)

## 3. Methodology

### 3.1 The Data

Data for this study come from the classroom observation study carried out by the Education Research Program at the African Population and Health Research Center. The classroom observation study involved collection of data from a randomly selected school from pre-selected districts. The sampling was done at two levels: Selection of districts by performance in their Kenya Certificate of Primary Education (KCPE). KCPE is a summative examination at primary level and it is used for screening in order to determine who transits to secondary school. Districts were first stratified into 10 quintiles according to their performance in KCPE for four consecutive years. Using this criterion, six districts were randomly selected: 1) two districts from those that had consistently been ranked in the bottom 10%; 2) two districts from those that had been consistently ranked within the middle 20%; and 3) two districts from those that had been consistently ranked in the top 10%. The other level of sampling involved random selection of schools from the sampled districts. The selection of schools was also informed by how they performed in the KCPE during the same period. Schools within each district were ranked into 5 quintiles (of each 20%) according to their performance in KCPE. Thereafter a random selection of six schools that were ranked consistently at the top 20% and six ranked consistently at the bottom 20% was undertaken in each of the sampled districts. In total, 72 schools were randomly selected, 12 from each of the six districts. The selection of schools was also carried out in a way to ensure a mix of rural, peri-urban and urban schools in the sample. The districts selected included Nairobi, Murang'a, Baringo, Gucha, Embu and Garissa.

The study involved a mixed method approach and data was collected using observation checklists, questionnaire and filming of actual lesson for three subjects (Math, English and Science) from class six pupils, their subject teachers and the school head. The study also involved testing grade six math pupils and as well as their math teachers. Data collection was undertaken in two rounds: The first round involved filming of the subjects actual lessons and coding of a classroom observation checklist, collection of teacher, pupil and school characteristics and testing of the grade 6 pupils in math as well as their teachers. The test given to the pupils was not the same as that given to their math teachers. During the second round, the same grade six pupils were tested using the same math test; however this time the questions were re-shuffled. The second round also involved collection of opportunity to learn (OTL) data, particularly curriculum coverage.


This study also uses data from video filming and a teacher characteristics questionnaire. In total 213 video recordings were collected (72 math, 70 English, and 71 science) from the 72 sampled schools. The teacher characteristic questionnaire was administered to 201 teachers (190, 10 and 1 teaching one, two and all the three subjects respectively) and it collected information on teacher attributes such as age, sex, experience, level of education and professional qualifications. It also gathered data on teacher socio-economic status, the internal and external support teachers had received, their attitudes towards using various teaching activities such as listening and speaking, working alone to solve problems, home assignments and examinations as well as on teachers' expectations of pupils and the goals they set for themselves with regard to their teaching (Ngware, et al 2010).

## 3.2 Analysis

The objective of this study is to investigate the patterns of teaching styles and active teaching across subjects and between low and high performing schools in order to have a deeper understanding of what could account for in performance differences between these schools. The outcomes of interest are teaching style and active teaching. Teaching style is measured by the dominant teaching practice in a lesson and type and kind of questions asked during the lesson; while active teaching is the proportion of time spent on a task that involved pupil-teacher interaction during the lesson and maximized learning opportunity. Time was measured by the number of minutes spent on specific activities that were classified to involve active teaching during video analysis. The next section describes the approach used during video time-segment analysis.

## 3.3 Video analysis

This study uses the classroom verbal interaction and time-segment video analysis of the lesson in order to characterize the classroom discourse and understand the teaching and learning styles employed by teachers as well as the activities taking place in the classroom. The time-segment video analysis involved used a systematically developed video analysis rubric in order to ensure a systematic and objective way of coding (Sorto, et. al., 2009). The rubric included four broad teaching and learning actives (individual seat work, recitation, group work and whole class) with specific activities under each one of them. The videos data were analysed by two internal video analysts with expertise and long experience in teacher training programs. In the analysis, the video analysts were to code under the specific activities the most dominant specific activity for every lesson minute. The coding was done independently by each of the video analysts and then jointly (consensus coding). An external video analyst validated the analysis. The analyses by the external expert did not significantly differ from that of the internal expert. In order to determine the dominant teaching practice used in each lesson, the time spent on each of the specific teaching and learning activity under each domain were summed together. The proportion of time spent in



each of the four domains, in each of the lesson observed, was calculated and the teaching style that took up the largest proportion of lesson time was then coded as the dominant teaching and learning activity. There were only two lessons that attempted to utilise group work. During our analysis, we observed that in those two lessons, learners sat in a group but to a larger extent worked as a 'whole class'. These two observations of group work were therefore recoded to reflect whole class.

The second component of video analysis involved the analysis of the verbal interaction taking place in the classroom between the pupils and teachers. This component entailed identification of questions directed to the pupils, their responses and the teacher follow-up moves. The questions were then mapped into the four levels of cognitive demand in order to assess their levels of difficulty (Stein, Smith, Henningsen & Silver, 2000). Easy questions were placed in the low levels 1 and 2: level 1 was knowing or memorization, and level 2 was questions that required the pupil to perform a routine procedure or conceptualise without connection; difficult questions were placed in the high levels 3 and 4: level 3 was questions that required the pupil to perform a complex procedure in order to get a solution, while level 4 was problem solving. The teacher follow-up moves involved how the teacher responded to the people responses and were categorized into five levels: 1) very encouraging feedback (e.g. very good, keep it up, well done); 2) encouraging feedback (good/ok/fine/correct/right/yes, try again, a good trial or teacher affirms the response); 3) neutral feedback (teacher probes, teacher gives the answer, teacher proceeds to confirm the correctness of the response from a pupil or class), 4) discouraging feedback (teacher proceeds to ask another pupil to respond to the same question, teacher says nothing and proceeds to another issue or task) and 5) very discouraging feedback (incorrect/not right/no, poor/very poor/wrong, teacher uses unpalatable language).

In order to understand the relationship between patterns of teaching, teaching style and the type of school, this study uses descriptive statistics including percentages, means and frequencies. To find out differences in teaching styles across subjects and schools, ANOVA analysis technique is used to understand teacher and school characteristics that have significant relationship with patterns of teaching styles and active teaching, we fit an ordinary least squares regression (OLS) with time spent on active teaching as the outcome.

### 3.4 Measurement of outcomes

- 1) Active teaching in this study is defined as the proportion of lesson time spent on activities that directly promote teacher-pupil interactions and maximise learning opportunity. In total, the video rubric had 33 specific teaching activities of which 11 (33.3%) were identified to involve active teaching (Table 1). The amount of time spent in the 11 active teaching activities was tallied and the proportion relative to lesson duration calculated in cases where the lesson was more than 35 minutes, else used 35 minutes.

This is due to the fact that a single lesson in Kenya Upper Primary (grades 4 to 8) school is 35 minutes long.

- 2) **Dominant teaching style:** The dominant teaching style was determined by tallying the amounts of time spent in each of the specific activities under that domain. The proportion of time in relation to the lesson duration was calculated. The teaching and learning style that took much of the time was coded as the dominant one. The three dominant teaching styles were individual seat work, whole class and recitation. Using Mosston's spectrum of teaching styles, the first observed style is similar to the task/practice style while the last two are similar to the command style. These observed styles are teacher-centered and are to promote reproduction of knowledge.
- 3) **Classroom verbal interaction –** This refers to the pupil-teacher interactions observed in questions and answer sessions. It involved teacher asking questions, student responses and teacher follow-up moves. In our analysis, verbal interaction is used to characterize the classroom discourse within each subject.

## 4. Results and discussion

### 4.1 Background characteristics

Table 2 shows the background characteristics at both the teacher and school level. The teacher characteristics do not vary by school category, with an exception of wealth index, where 42.9% of teachers from the bottom schools were ranked in the poorest category compared to 24.3% of teachers from the top school category.

**Table 2: School and teacher background characteristics**

		Top schools	Bottom schools	P-Value
Teacher characteristics (n=201)		Number (%)	Number (%)	
Mean age†	Years	38.30	37.69	0.949
Teacher sex	Female	47 (45.63)	39 (39.80)	0.403
	Male	56 (54.37)	59 (60.20)	
Teacher experience	10 yrs or less	31 (30.10)	43 (43.88)	0.083
	Between 11 to 20 yrs	44 (42.72)	29 (29.59)	
	Above 20 yrs	28 (27.18)	26 (26.53)	
Teacher training	No Teacher Education	15 (14.56)	18 (18.37)	0.110
	Certificate	74 (71.84)	75 (76.53)	
	Diploma/Degree	14 (13.59)	05 (05.10)	
Teacher wealth Index	Least poor	40 (38.83)	30 (30.61)	0.020
	Middle	38 (36.89)	26 (26.53)	
	Poorest	25 (24.27)	42 (42.86)	

<b>School characteristics (n=72)</b>				
Average class size†		<b>38.97</b>	<b>29.06</b>	0.107
Poverty (20%) †	Poorest 20%	<b>13.74</b>	<b>24.59</b>	0.079
Poverty (40%) †	Poorest 40%	<b>28.42</b>	<b>50.17</b>	0.001
PTR	PTR: < 26	09 (25.00)	12 (33.33)	0.675
	Between 26 and 45	20 (55.56)	19 (52.78)	
	PTR: > 45	07 (19.44)	05 (13.89)	
Teachers math score		62.83	57.72	0.19
Pupil mean scores in math test 1		<b>53.21</b>	<b>39.93</b>	0.001
Pupil gains scores in math		<b>10.37</b>	<b>8.49</b>	0.001
† Mean/averages reported				

On school characteristics, average class size and pupil teacher ratio (PTR) were not significantly different between the bottom and top performing schools. Nevertheless, top schools had larger class sizes (mean of 39) compared with bottom schools (mean of 29). Significant difference was however observed in school poverty levels. The school poverty level was calculated as a function of the proportion of pupils from a particular school ranked either in the 20% or 40% poorest category in each of the sampled district; this reduces the indicator to school level. The results show that 50% of the bottom schools were ranked in the 40% poorest category compared to 28% of the top schools. Significant differences are also noted in the school math mean scores, where the top schools scored significantly higher than the bottom schools. This is also evident on pupil gain scores; despite the bottom schools scoring significantly lower in round 1 testing, they also gained significantly less marks compared to pupils from the top schools.

## 4.2 Dominant teaching and learning activity

Table 3 shows the proportion of lessons using the various dominant teaching style by school category and subject. It is apparent in all lessons and subjects there was a mix of styles; however the dominant teaching style varied by subject and sometimes by school category. In math lessons, the dominant style was individual seat work; when split by school type this activity was dominant among the bottom schools (50.0%) while in the top schools both individual seat work (36.1%) and whole class work (36.1%) were commonly used.

**Table 3: Dominant teaching style by school category and subject**

Teaching style	School Category	Math	English	Science
Individual seat work	Top schools	13 (36.11)	6 (17.14)	5 (14.29)
	Bottom schools	18 (50.00)	8 (22.86)	7 (19.44)
Recitation	Top schools	10 (27.78)	24 (68.57)	7 (20.00)
	Bottom schools	5 (13.89)	15 (42.86)	8 (22.22)
Whole class	Top schools	13 (36.11)	5 (14.29)	23 (65.71)
	Bottom schools	13 (36.11)	12 (34.29)	21 (58.33)

In the English lessons, recitation was the dominant teaching activity; over two-thirds (68.6%) of the teachers from top schools and 42.9% from the bottom schools dominantly used recitation in their English lessons. Science teachers employed whole class approach with 65.7% and 58.3% of the teachers in top and bottom performing schools using this method. These observed dominant teaching styles seem to characterize teaching elsewhere in Africa. For example, in Northern Nigeria, Hardman, Abd-Kadir and Smith (2008) found the prevalence of teacher directed descriptions, recitation and rote learning being a norm.

Table 4 shows the cumulative proportion of time in each of the subjects and by school category spent on the different styles. The style that took much of the time is the dominant one and this varied by subject and school. While in the top schools there was a mix of individual seat work, recitation and whole class approaches, the bottom schools mainly used individual seat work and whole class. Majority of the Science lessons were characterized by whole class and recitation while English lessons recitation was dominantly used. These instructional characteristics resemble what the Hardman, et al (2008) study found in Nigeria – individual seat work as the teacher goes round checking individual work in Math and Science subjects while recitation dominated English lessons.



**Table 4: Proportion of time spent on the dominant teaching style by school type and subject**

Subject	Style	Top schools (%)	Bottom Schools (%)
Math	Individual seat work	31.80	32.84
	Recitation	30.62	26.50
	Whole class	33.9	36.58
	Other†	3.69	4.08
English	Individual seat work	18.59	17.46
	Recitation	50.93	43.73
	Whole class	27.33	34.06
	Other†	3.14	4.75
Science	Individual seat work	16.98	19.83
	Recitation	32.59	31.90
	Whole class	46.65	42.22
	Other†	3.77	4.05

Notes: † Refers to transitional activities such as disruptions and switching from one activity to another,

### 4.3 Verbal interactions during instruction

Type and nature of questions asked within a lesson depict the nature of teaching and learning style employed by the teacher (Table 5). Simple and repetitive questions were common in all lessons, subjects and irrespective of the school category. The bottom schools were however characterised by a significantly higher proportion of their lessons having very few or no questions at all (18.7%) as compared with top schools (5.7%). Questions of higher level of cognitive demand were virtually absent among the top (2.8%) and bottom (0.9%) performing schools and across the three subjects. Other studies, for instance, Carnoy et al (2008) and Hardman, et al (2009) found similar patterns – simple and repetitive questions in South Africa and Kenya based studies, respectively. It would appear that this is a common characteristics of instructional discourse in primary schools in Africa.

**Table 4: Type and level of questions and teacher follow-up moves across the three subjects by school category**

	Top Schools			Bottom schools		
	Math n (%)	English n (%)	Science n (%)	Math n (%)	English n (%)	Science n (%)
<b>Type of question asked</b>						
Few/No questions	2 (5.56)	2 (5.71)	2 (5.71)	5 (13.89)	9 (25.71)	6 (16.67)
Simple and Repetitive	34 (94.44)	32 (91.43)	31 (88.57)	31 (86.11)	25 (71.43)	30 (83.33)
Give example/short answer	0 (0.00)	1 (2.86)	2 (5.71)	0 (0.00)	1 (2.86)	0 (0.00)
<b>Level of cognitive demand of question</b>						
Level 1	774 (66.38)	1215 (91.08)	1481 (94.81)	1027 (71.12)	1176 (89.7)	1271 (95.64)
Level 2	376 (32.25)	9 (0.67)	20 (1.28)	407 (28.19)	3 (0.23)	16 (1.2)
Level 3	16 (1.37)	110 (8.25)	57 (3.65)	10 (0.69)	132 (10.07)	39 (2.93)
Level 4	0 (0.00)	0 (0.00)	4 (0.26)	0 (0.00)	0 (0.00)	3 (0.23)
<b>Teacher follow-up moves</b>						
Very encouraging	33 (2.83)	72 (5.4)	131 (8.39)	22 (1.52)	88 (6.72)	111 (8.35)
Encouraging	577 (49.49)	657 (49.25)	882 (56.47)	668 (46.26)	695 (53.05)	682 (51.32)
Neutral	174 (14.92)	91 (6.82)	122 (7.81)	165 (11.43)	139 (10.61)	111 (8.35)
Discouraging	365 (31.3)	433 (32.46)	401 (25.67)	560 (38.78)	374 (28.55)	377 (28.37)
Very discouraging	17 (1.46)	81 (6.07)	26 (1.66)	29 (2.01)	14 (1.07)	48 (3.61)

Across the three subjects, three quarters of the teacher questions were categorised as level 1 and only required memorization or knowing and the question level of difficulty did not vary by school category. Low level questions were common in English and Science lessons. Higher level questions (level 4, that included questions that involved complex procedures to get a solution) were absent in English and Math lesson, and were present in less than 1% of the science lessons. In a South Africa, the study by Carnoy et al. (2008) found majority (77%) of lessons require students to simply recall rules and definitions with no connection to underlying concepts. The earlier study in Kenya (see Hardman, et al. 2009) found that questioning was characterised by 'cued elicitation', that is, mid-sentence rise in teacher's voice to prompt a response from the learner or repeat of what the teacher has just said.

The way the teacher responds to a pupil or class after response has a direct influence on classroom interaction. The teacher follow-up moves in this study were categorised into five categories: Very encouraging, encouraging, neutral, discouraging and very discouraging. The results show that though teachers have encouraging follow-up moves, this is still below average (50%); and this cuts across the three subjects and school category. Across the three subjects, one third of the pupil responses were coupled by discouraging teacher follow-up comments and this happened in most instances where the pupil response was incorrect. Table 6 shows some selected examples of classroom verbal interaction. In the Hardman et al (2009) study, upto 30% of student responses were not followed-up by the teacher, while in another 10-15%, the teacher simply affirmed the response. Incidences of the learner being praised after responding were low, that is, slightly over 10% in Math and Science, and below 10% in English. Our study seem to record an improvement among teachers in encouraging or praising learners and this may act as a motivation to learn.



**Table 6: Classroom verbal interactions**

	<b>Teacher question</b>	<b>Pupil Response</b>	<b>Response Right?</b>	<b>Teacher Follow up move</b>
Math	What time would it be by the 24 hour clock when it is 8.00am by the 12 hour clock?	008 hrs	Incorrect response	Well done
	Which number will you multiply by 25 to give you equivalent or near to 100?	7	Incorrect response	No
English	If we are still learning English and another teacher comes in and asks what you have been doing or one of our quests comes back and asks, what will you tell them in the past passive tense?	We were learning English	Incorrect response	Not right
	Can someone make a sentence with a qualifier and tell us where we have that qualifier?	The bicycle you rode to school has a puncture	Correct response	Very good
Science	Can someone give me one of the uses of carbon dioxide?	Transpiration	Incorrect response	No
	What is a paddock so that we can understand the word paddocking?	A paddock is a small fenced piece of land where animals are fed and kept	Correct response	Very good

## 4.4 Teacher preparedness

Table 7 shows the distribution of self reported teacher preparedness. The interviewed teachers were asked to rate themselves how adequate they are prepared to implement the curriculum of the subject they teach. The results show insignificant association between preparedness and subject, teacher gender and school category. However there is significant association between teacher preparedness to teach subject and teacher experience. That is, most teachers who have taught for 11 years and above felt just adequate or inadequate enough to teach the subject in question. For those who had taught for less than 10 years, 47% reported that they are very adequately prepared to teach the subject curriculum as compared to 11% of those who had taught for more than 10 years. The results indicate that newer teachers are enthusiastic to teach as compared to those who have taught for long. This can be partly explained by the fact that 78.9% of the teachers had never attended an in-service training in the last 18 months preceding the study in spite of majority of them having taught for at least 5 years. Available literature on teacher preparedness to teach observes that teachers feelings of preparedness may influence their ability to perform teaching tasks (Housego, 1990).

**Table 7: Self reported teacher preparedness to teach**

Variable		In-adequate n (%)	Adequate n (%)	Very Adequate n (%)	P-value
<b>Subject</b>	Math	8 (11.11)	29 (40.28)	35 (48.61)	0.211
	English	10 (14.29)	39 (55.71)	21 (30)	
	Science	11 (15.49)	30 (42.25)	30 (42.25)	
<b>Teacher sex</b>	Female	12 (13.19)	37 (40.66)	42 (46.15)	0.313
	Male	17 (13.93)	61 (50)	44 (36.07)	
<b>school category</b>	Top	9 (8.49)	53 (50)	44 (41.51)	0.083
	Bottom	20 (18.69)	45 (42.06)	42 (39.25)	
<b>Teacher experience</b>	10 yrs or less (r)	20 (11.56)	71 (41.04)	82 (47.4)	0.001
	Between 11 to 20 yrs	1 (33.33)	2 (66.67)	0 (0)	
	Above 20 yrs	8 (21.62)	25 (67.57)	4 (10.81)	

## 4.5 Patterns and time spent on active teaching

Another aspect of teaching style is the time spent on active teaching activities. The proportion of time taken by each specific activity is calculated as a function of total time on active teaching rather than lesson duration. Table 8 shows the proportions of lesson time spent on each of the active teaching activities, while Figure 3 illustrates the same graphically. Overall, 62% of the lesson time was used in active teaching; this did not vary by subject i.e. Math- 61.5%, English- 62.6% and Science – 62.3%. After splitting by school category, 63.2% and 61.2% of the lesson time was used in active teaching among the top and bottom performing schools respectively and the difference was not statistically significant. The proportion of the lesson time spent on active teaching is considerably high and has a potential of enhancing learning opportunities. Literature suggests that the higher the active teaching time spent the higher the learning achievement (see for example Louw, Muller & Tredoux, 2008). But our findings also show that the main styles of teaching across the three subjects are those associated with reproducing knowledge and heavily teacher-centered, thus unlikely to develop adaptive and critical learners. We therefore think that the learning gains made from the high proportion of active teaching time spent during instruction is eroded by the teacher-centered teaching styles that may not provide opportunities for developing high cognitive abilities among learners.



**Table 8: Proportion of time spent on active teaching by active learning activity**

Specific Activity	Q's Number	Math	English	Science
Teacher checking work Individual (working)	Q10d	0.280	0.159	0.023
Teacher checking work Individual (stopped)	Q10e	0.012	0.004	0.009
Q_A: Individual learner (Teacher asks)	Q11a	0.219	0.413	0.322
Q_A: Individual learner (Learner asks)	Q11d	0.002	0.006	0.007
Teacher checking -work group (working)	Q12g	0.019	0.000	0.008
Teacher checking -work group (stopped)	Q12h	0.000	0.000	0.000
Whole class task instructions (Teacher only)	Q13a	0.040	0.038	0.020
Whole class demonstrations (Teacher only)	Q13b	0.338	0.266	0.415
Whole class lecture (Teacher only)	Q13c	0.085	0.107	0.177
Whole class review/Recap (Teacher only)	Q13d	0.003	0.004	0.014
Whole class evaluate lesson (Teacher only)	Q13e	0.001	0.002	0.005
<b>Overall: Top school</b>		<b>0.633</b>	<b>0.621</b>	<b>0.620</b>
<b>Overall: Bottom school</b>		<b>0.612</b>	<b>0.609</b>	<b>0.631</b>
<b>OVERALL</b>		<b>0.615</b>	<b>0.625</b>	<b>0.626</b>

Teachers in top schools spend approximately 2 percentage points more of their time in active teaching compared to those in bottom schools in Math and English subjects. On proportion of time spent on each of the active teaching activity, the results show that in each of the three subjects, there were common activities that cumulatively took more than 75% of the active teaching time. They included teacher checking learner's work while the learner was working (Q10d); teacher asking an individual learner a question (Q11a); and teacher demonstrates to the whole class how to carry out a task (Q13b). The study by Hardman, et al (2009) found that cued elicitation and checking student work were ritualised in a lesson and took almost the entire lesson time.

Based on the time spent on active teaching and the main teaching styles observed in our study, the emerging scenario is that of classroom discourse that is teacher driven with little opportunities for learner participation. To put this into perspective, Figure 1 presents our observation and casts this on Mosston's spectrum of teaching style (McCullick & Byra, 2002; Mueller & Mueller, 1992).

**Figure 1: Comparing the observed teaching styles to the spectrum of teaching styles**

Observed Teaching styles		Spectrum of teaching styles	
Not present	Learner-centered and productive styles	Self-teaching	
Not present		Learner initiated	
Not present		Learner-designed individual program	
Not present		Convergent & Divergent discovery	
Not present		Guided discovery	
Not present		Inclusion	
Not present		Self-check	
Not present		Reciprocal	
Individual seat work		Teacher-centered and reproductive styles	Task/practice
Recitation & Whole class style			Command

From figure 1, the observed teaching styles in our sample primary school can only be compared to the command and /or task style in the Mosston's spectrum of teaching styles. This implies a heavily teacher-centered and reproductive styles that may not develop critical thinking among learners. Figure 2 shows a cross-sectional representation of teaching time in a typical lesson based on our data. From the figure 2, 38% of lesson time is spent on activities that do not directly enhance learning while 46.5% of lesson time is spent on three activities. Our analysis shows that across all subjects, 48% of the lessons spent up to a quarter of the lesson time in Zone A; 86.4% of the lessons spent up to 25% of lesson time in Zone B; and, 49.3% of lessons spent up to half of teaching time in Zone C. This is a clear demonstration that in a considerable proportion of lessons, teaching time is not being optimized in a way to enhance learning opportunities. But even if it were to be optimized, the reproductive inclined teaching styles will compromise any gains made on active teaching time.

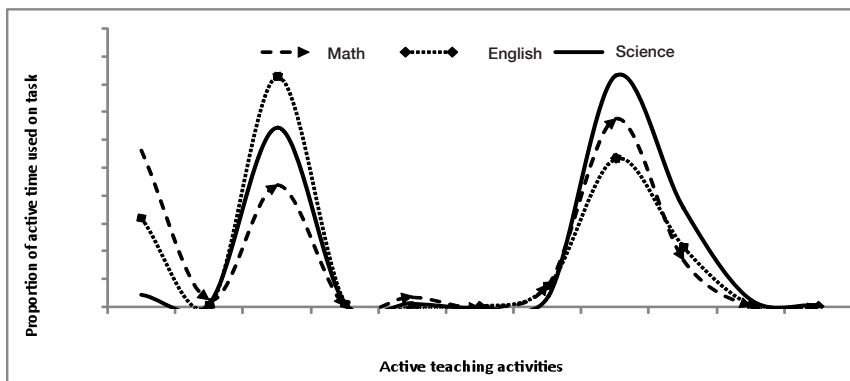


**Figure 2: Distribution of teaching time during a lesson**

38%	15.5%	46.5%
Zone A	Zone B	Zone C
<b>Inactive teaching time</b>	<b>Active teaching time (62%)</b>	
Activities that do not directly enhance learning opportunity, Eg. transitioning	Other activities in Table 8 except Q10d, Q11a & Q13b, less common activities	Activities Q10d, Q11a & Q13b in Table 8, common activities in lesson

Figure 3 shows that the activities taking most of the lesson's active teaching time did not differ by subject though the actual proportion of time spent in each activity was slightly different. In English lessons, question and answer verbal interaction where the teacher asks questions was the dominant active teaching activity (41.3%); whole class demonstration (41.5%) took most of the active teaching time in science subject; while in math, whole class demonstration took 33.8% of the teaching time. From these statistics, one can say that teachers used similar patterns of teaching styles regardless of the subject. From Appendix 1, time spent on active teaching activities is a function of lesson duration. This implies that if teachers, for instance, do not teach for the entire duration of the lesson, then learning opportunities are missed. This relationship (between lesson duration and active teaching time) demystifies the popular thinking that all what matters is 'what you know' and 'what you teach in the first few minutes' that leads to learning, regardless of how long it takes to do it.

**Figure 3: Proportion of active time spent on each of the active teaching and learning activities**



Notes: See Table 8 for a full description of activities



In order to understand if patterns of teaching differ within and between schools and by school categories, we fitted a one way ANOVA with (1) schools as the grouping factor, irrespective of the subject; and, (2) school category as grouping factor and for each subject. We use ANOVA, in Table 9, to show the variation that is attributable to the grouping (between group variation) and the variation that is unexplained (within group variations). Considering subjects as independent observations made in each school, results show that 43.9% of the variation is between schools (attributable to grouping effect), which is statistically significant; therefore the variability of proportion of active teaching time between subjects in the same school is less than the variability between the underlying proportions of active teaching time between different schools.

**Table 9: ANOVA results for effect of school on teaching style**

Source of Variation	SS	df	F -ratio & P - value
School (Between)	2.723892	71	F=1.56 P=0.0136
Residual (Within)	3.477378	141	
Total	6.201270	212	
R-Squared		0.4392	


SS=Sum of squares; df=degrees of freedom

In Math and English lessons, school category accounts for less than 1% of the total variation of time spent on active teaching. In Science lessons, the variation accounted by school category is 3.27%; however, much of the variation remains unobserved for (within schools category). Therefore, across the three subjects, much of the variation on time spent on active teaching is observed within the groups, with insignificant between group variations.

**Table 10: ANOVA results for effect of school category on teaching style by subject**

Source of Variation	Math		English		Science	
	SS	df	SS	df	SS	df
<i>Model</i>	0.002600	1	0.002041	1	0.066371	1
School Category	0.002600	1	0.002041	1	0.066371	1
Residual	2.165561	70	1.993828	68	1.965946	69
Total	2.168161	71	1.995869	69	2.032317	70
R-Squared		0.0012		0.001		0.0327

SS=Sum of squares; df=degrees of freedom



This study also sought to understand whether there are significant effects of teacher and school characteristics on patterns of teaching styles and active teaching. Teacher characteristics included: Teacher years of teaching experience, gender, age, academic qualifications, confidence and teacher socio-economic characteristics; school characteristics included PTR, average class size, school size and school SES (Table 11 and 12). The results show insignificant effects of most of the school and teacher characteristics on time spent on active teaching with an exception of the type of questions asked during the lesson. That is, lessons with tasks/questions of high level of cognitive demand utilized a higher proportion of lesson time (14.7%) on active teaching as compared to those that had lower level questions. An evaluation conducted in seven schools in the Pemberton School District, USA, reported a positive relationship between the time taken to complete lesson activities and test scores (Clariana, 2008). Though USA is not a perfect comparison of developing countries, the relationship between time and learning, is an important limiting factor in instructional delivery (Clariana, 1998; Horn, 2007; McMurrer, 2007). Therefore, meaningful time on task, for instance, instructing pupils on new concepts and not using time to teach what they already know, is an efficient use of time. Effective lesson planning on content coverage and careful execution of the same is therefore critical for meaningful use of active teaching time.

Table 11 also shows the amount of variation that is attributable to each of the teacher and school characteristics. It is apparent that with an expectation of pupil teacher ratio and types of questions asked in the classroom, each of the other variables explains less than 1% of the lesson time spent on active teaching. Table 12 shows the separate effects of school and teacher characteristics. This helps understand which characteristics have a higher impact on time spent on active teaching. The separate r-squared for the teacher and school multiple regression results are 2.2% and 4.5% respectively. This gives an indication that the school characteristics have a much larger effect on teaching style compared with the teacher characteristics. Perhaps an indication of the different school contexts and or ethos.

Further analysis of our data shows that there is no significant association between number of teaching years and dominant teaching style by subject. Teaching for a long time does not make one necessarily teach any different from a newly recruited teacher. Both long serving and inexperienced teachers taught in a similar way – teacher centered - indicating the existence of either (1) Poor pre-service teacher preparation in pedagogical skills; (2) Inadequate on-job skill upgrading through in-service program; and/or (3) Weak teacher support programs, for example, professional guidance through supervision and peer evaluations. A further investigation of teaching style reveals a significant association in the style of teaching English and teacher's gender. In every 10 female teachers, 7 to 8 used recitation compared to 4 to 5 in every 10 male teachers; this association is not seen in the math and science lessons.

**Table 11: Univariate regression coefficients showing effect of school and teacher characteristics on teaching style**

Variable		Coefficient	t-statistic	constant	R-squared
<b>Teacher characteristics</b>					
Mean age	Years	0.000	0.39	0.603	0.001
Teacher sex	Female (r)	0		0.628	0.001
	Male	- 0.010	-0.37		
Teacher experience	10 yrs or less (r)	0		0.629	0.009
	Between 11 to 20 yrs	0.004	0.14		
	Above 20 yrs	- 0.034	-0.88		
Teacher training	No Teacher Education(r)	0		0.620	0.001
	Certificate	0.000	0.02		
	Diploma/Degree	0.020	0.41		
Teacher wealth index	Least poor (r)	0		0.618	0.002
	Middle	- 0.002	-0.08		
	Poorest	0.015	0.54		
Subject	Math (r)	0		0.615	0.001
	English	0.010	0.40		
	Science	0.010	0.40		
Variable		Coefficient	t-statistic	constant	R-squared
<b>School characteristics</b>					
School Category	Bottom (r)	0		.633	0.004
	Top	- 0.021	-0.78		
Average class size		0.001	1.23	0.592	0.008
Poverty (20%)		0.001	0.92	0.610	0.004
Poverty (40%)		0.000	0.13	0.619	0.000
PTR	PTR: < 26 (r)	0		0.586	0.019
	Between 26 and 45	0.054	1.68		
	PTR: > 45	0.038	0.93		
Public school	No (r)				
	Yes	0.010	0.31	0.614	0.001
Questions asked	Few/No questions (r)	0		0.637	0.019
	Simple and Repetitive	- 0.020	-0.51		
	Give example/short answer	0.147**	2.51		

\*\* Significant at 5% level of significance; \* Significant at 10% level of significance

r – reference category



**Table 12: Multivariate regression coefficients showing effect of school and teacher characteristics on teaching style**

Variable		Teacher characteristics	School characteristics	
		Coef [t-statistic]	Coef [t-statistic]	
<b>Teacher Characteristics</b>	Years	0.002 [1.46]		
	Mean age			
	Teacher sex	Female Male	0 -0.009 [-0.32]	
	Teacher experience	10 yrs or less (r) Between 11 to 20 yrs Above 20 yrs	0 -0.02 [-0.56] -0.067 [-1.53]	
	Teacher training	No Teacher Education (r) Certificate Diploma/Degree	0 -0.007 [-0.24] 0.022 [0.46]	
	Teacher wealth Index	Least poor (r) Middle Poorest	0 -0.004 [-0.12] 0.016 [0.56]	
	Subject	Math (r) English Science	0 0.015 [0.55] 0.016 [0.60]	
<b>School characteristics</b>				
School Category	Bottom(r) Top		-0.026 [-0.83]	
Average class size			0.000 [0.15]	
Poverty (20%)			-	
Poverty (40%)			0.000 [0.58]	
PTR	PTR: < 26 (r) Between 26 and 45 PTR: > 45		0 0.063 [1.50] 0.044 [0.87]	
Public school	No (r) Yes		0 -0.035 [-0.71]	
Questions asked	Few/No questions (r) Simple and Repetitive Give example/short answer		0 -0.027 [-0.61] 0.137* [2.05]	
Constant		0.556 [7.9]	0.648 [8.79]	
R-squared		0.0222	0.0453	

\*\* Significant at 5% level of significance; \* Significant at 10% level of significance

r – reference category

## 5. Conclusions and implications

The purpose of this paper was to find out whether there are difference in teaching styles and active teaching time across three subjects taught in primary schools in Kenya. We also set out to examine the association between the patterns of teaching and teacher/school characteristics. Our analysis arrives at the following key findings: (1) Teachers taught in a similar way regardless of their teaching experience, school category (high or low performing) and subject (Math, English and Science). Except in the utilisation of recitation (a command style of teaching) in the teaching of English, other teaching styles did not differ by teacher gender; (2) In all category of schools and across all subjects studied, the teaching styles are predominantly teacher-centered – particularly command and practice styles; (3) On average, active teaching time takes up almost two-thirds of the lesson teaching time – with active teaching being concentrated on three activities, that is, teacher checking how individual learners carry out teacher-assigned tasks, teacher asking individual learner questions and teacher demonstrating to a whole class; (4) Although teacher-centered, each of the subjects had a dominant teaching style – recitation for English, individual seat work in math and whole class chorus in Science.

We conclude that the current teaching styles in use in Kenya primary school classrooms do not enhance opportunities to learn and will lead to learners who reproduce knowledge rather than learners who produce knowledge for a growing economy; (5) Using the Moss-ton continuum of teaching styles, in the 213 lessons observed in Math, English and Science subjects, only the command and practice/task styles were therefore evidenced in primary school teaching in Kenya; and 6) There exists higher variability of teaching patterns across the three subjects between schools than within schools.

The key policy implication emerging from this paper is on pre-service and in-service teacher preparation programs that may not be adequately preparing teachers for a broad spectrum use of teaching styles – particularly the learner-centered styles. This is an area where the Ministry of Education and other stakeholders involved in teacher preparation program may have to initiate reforms aimed at revitalising teacher training programs and pedagogical skills of teachers in station.



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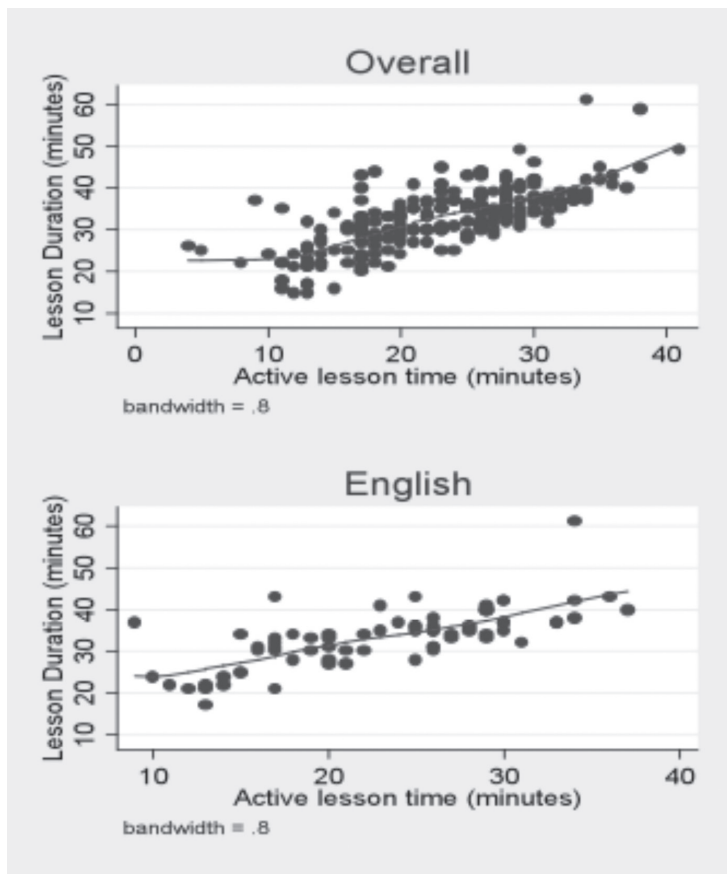
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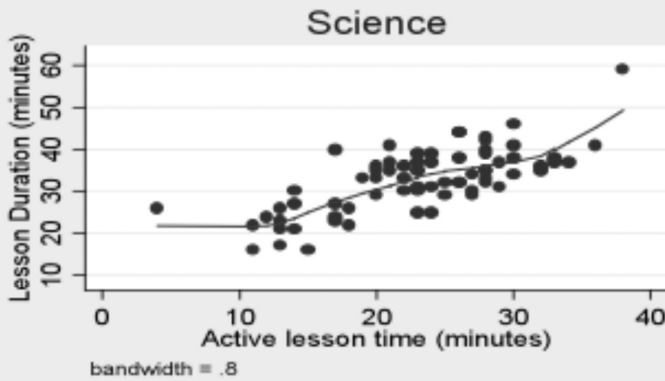
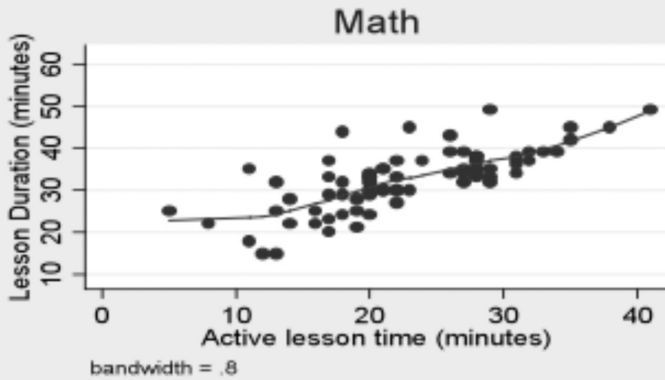
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# Appendix 1













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