The *Tayari* Pre-Primary Program in Kenya: Getting Children Ready for Primary School

APHRC

African Population and
Health Research Center

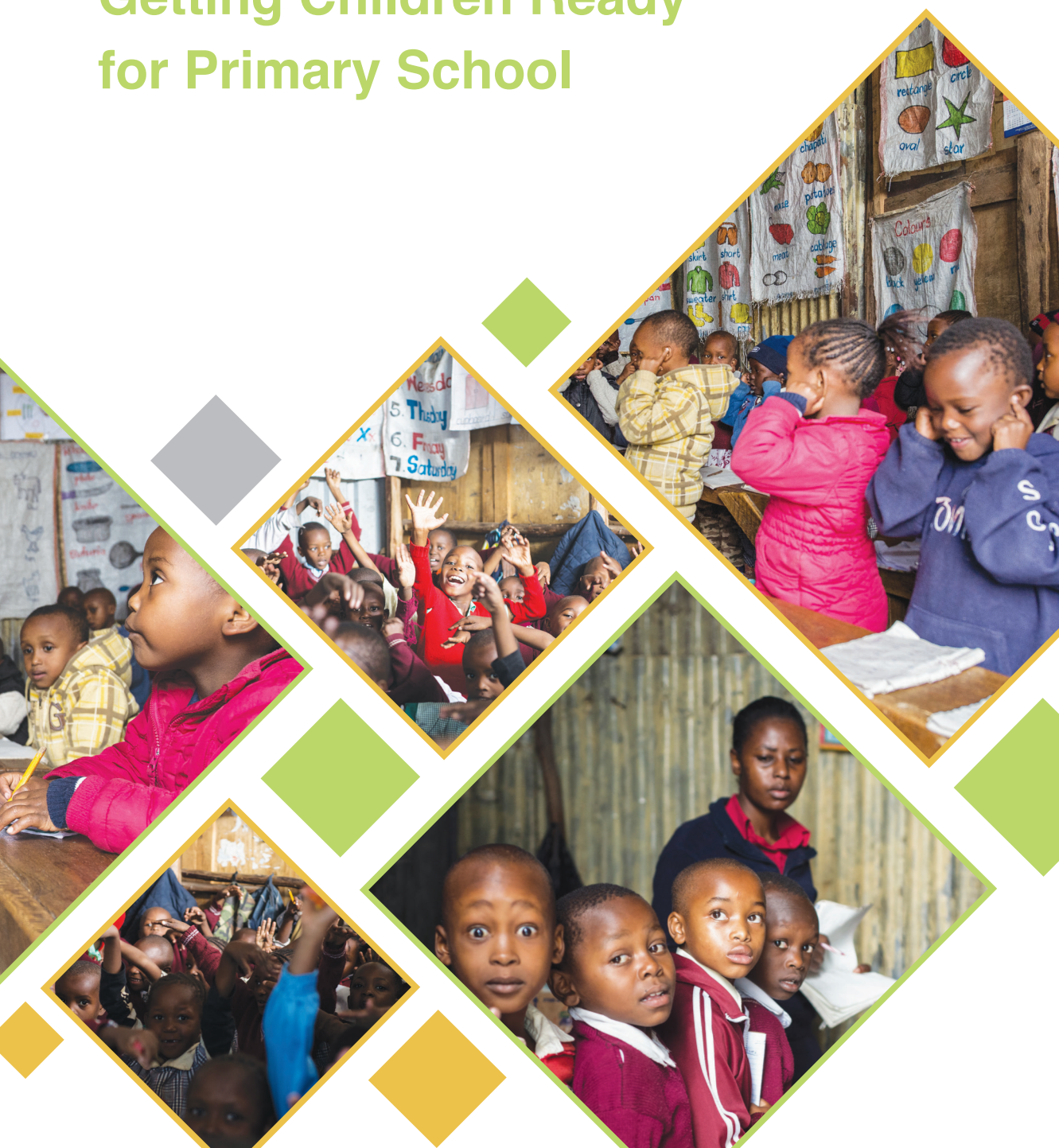**African Population and
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Outcome Evaluation Baseline Report

Table of Contents

Abbreviations and Acronyms

AKF	Aga Khan Foundation
AMREF	African Medical and Research Foundation
APBET	Alternative Provision of Basic Education and Training
APHRC	African Population and Health Research Center
CHW	Community Health Worker
CHA	Community Health Assistant
CHV	Community Health Volunteer
CIFF	Children's Investment Fund Foundation
DICECE	District Centre for Early Childhood Education
ECD	Early Childhood Development
ECDE	Early Childhood Development and Education
ECE	Early Childhood Education
EAQEL	East Africa Quality in Early Learning
FI	Field Interviewer
FPE	Free Primary Education
GER	Gross Enrolment Rate
KICD	Kenya Institute of Curriculum Development
KNEC	Kenya National Examinations Council
LCPC	Low-cost private centres
MELQO	Monitoring Early Learning, Quality and Outcomes
MoEST	Ministry of Education, Science and Technology
MRC	Madrasa Resource Programme
NACECE	National Centre for Early Childhood Education
NACOSTI	National Commission for Science, Technology and Innovation

OE	Outcome Evaluation
PE	Process Evaluation
PPS	Probability proportional to size
PRIMR	Primary Math and Reading
RCT	Randomized Control Trial
RSRI	Rapid School Readiness Initiative
RTI	
SD	Standard Deviation
SOS	Stallings Observation System
T1	Treatment 1
T2	Treatment 2
T3	Treatment 3
TSC	Teachers' Service Commission
UNESCO	
UNICEF	
VIP	Ventilated Improved Pit latrine

List of Tables

List of Figures

Acknowledgements

Executive Summary

This report describes the baseline findings of an external evaluation of the *Tayari*[1] pre-primary school programme. *Tayari* is an early childhood development and education (ECDE) intervention funded by the Children's Investment Fund Foundation (CIFF). The intervention is implemented by the RTI International, in partnership with the Ministry of Education, Science and Technology (MoEST), and in collaboration with four counties. The programme, which runs from January 2016 to October 2017, aims to develop a cost-effective, scalable model of ECDE that ensures children who are preparing to join primary grade one are cognitively, physically, socially and emotionally ready to start, and succeed in primary school. The programme focuses on improving school readiness as defined by learners' literacy, numeracy, psychosocial and executive function skills and targets pre-primary schools in both public and Alternative Provision of Basic Education and Training (APBET) centres in four Kenyan counties: Laikipia, Nairobi, Siaya and Uasin Gishu. As the programme's external evaluator, the role of the African Population and Health Research Center (APHRC) in *Tayari* is to assess the: (a) impact of the programme on preparing children for primary school; and, (b) cost-effectiveness of the programme.

The evaluation, which adopted a randomized control trial (RCT) design, involves three separate treatment arms and one control arm for each type of ECDE centre (public and APBET). The first treatment arm (T1) will receive two components of the intervention - DICECE training and teacher support; the second treatment arm (T2) will receive the two components in the first treatment plus books and teachers' guides; the third treatment arm (T3) will receive all the three components in the second treatment arm, plus a health/hygiene component. The control arm will receive no treatment.

Baseline results show that boys and girls were fairly distributed in the public sample as well as in the APBET sample. The vast majority of the teachers in both public and APBET centres had attained at least secondary school education and had at least certificate level of professional qualification. Within both public and APBET centres, most classroom sizes ranged from 13 to 16 learners, while the learner-teacher ratio was 15 to 1 in public centres, and 14 to 1 in APBET centres. The most commonly reported language of instruction in public centres was Kiswahili whereas in APBET centres, English was the most commonly used.

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[1] *Tayari is a Kiswahili word that means readiness.*

The few significant differences observed suggest that schools across all treatment groups in both public and APBET centres were fairly similar, allowing attribution of differences observed at the end of the intervention to the intervention itself. Nevertheless, the few differences observed will need to be taken into account when estimating the impact of the *Tayari* programme. The *Tayari* baseline balance could also mean that a model only looking at end-term comparison could be used to measure impact.

The majority of both public and APBET ECDE centres were attached to primary schools which simplifies future follow-up visits as the primary schools create an 'anchor of stability' for the ECDE centres. Because the majority of teachers were female, differences in performance according to teacher sex should be interpreted with caution.

In both public and APBET centres, performance of the learners on the *Tayari* school readiness index was generally low meaning that the learners did not possess a vast majority of the skills assessed by direct assessment test. This is in a way a positive finding because it means that the test can be used to measure learning gains in subsequent data collection waves without running into the risks associated with ceiling effects. For both types of ECDE centres, performance of learners in the control group was about the same as that of learners in the three treatment groups. This finding is important because it means there was baseline equivalence across the study groups.

Classroom observations revealed very similar trends across groups in the time that teachers and students engaged in specific activities. Across treatment arms within both public and APBET centres, very little time was spent engaging in actions that would encourage learners to work independently and cooperatively. This finding is of special interest because one key area of focus for the *Tayari* programme is to change teaching styles/behavior and this observation presents a good entry point for implementing changes in the way teachers engage with learners at this level.

1 Introduction

1.1   Background Issues

1.1.1   Importance of Early Childhood Development and Education

The first five years are critical for a child's development as during this period, the brain develops rapidly and is particularly responsive to early experiences and environments (Edie & Schmid, 2007). Children therefore stand to benefit immensely from early childhood development and education (ECDE) programmes. Highlighting the importance of ECDE, the first goal in the World Declaration on Education for All (Jomtien, 1990) which was updated and restated in the World Education Forum in Dakar in 2000 (UNESCO, 1990, 2000) emphasized "Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children." ECDE plays an important role in preparing children to be physically, socially, emotionally and cognitively ready for school (La Paro & Pianta, 2000). In reference to the Sustainable Development Goals (SDGs), the Secretary-General of the UN said that "The Sustainable Development Goals recognize that early childhood development can help drive the transformation we hope to achieve over the next 15 years" (Asia-Pacific Regional Network for Early Childhood, 2016). Target 4.2 of the Sustainable Development Goals recognizes the importance of ECDE when it states that "By 2030 ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education" (p4).

Participation in ECDE programmes is associated with higher levels of academic achievement and better adjustment during later years of schooling (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004), even among the most disadvantaged (Hungi, 2011). For instance, Berlinski and colleagues (2006) in their investigation on the effect of a large

expansion of universal pre-primary education on subsequent primary school performance in Argentina reported that one year of pre-primary school increased average third-grade test scores by eight percent. Because they are concerned with ensuring a solid foundation for children's overall development, ECD programmes have important implications for children's future life chances. Investment in the early years leads to huge returns both in human and financial terms as children who participate in ECD programmes do better in school, are healthier, have lower drop-out rates and as adults, become more economically productive, emotionally balanced and socially responsible (Arnold, Bartlett, Gowani, & Merali, 2006; Barnett, 1995).

1.1.2 The ECDE Situation in Kenya

The ECDE programme in Kenya has in the past mainly focused on custodial care and cognitive development of young children preparing to join primary school. The increased awareness of the importance of ECDE, mainly because of the large number of women with young children joining the work force (Republic of Kenya, 2006), has not only resulted in greater demand for, but also in the emergence of different modes of service delivery (Swadener, Kabiru, & Njenga, 2000). These include preschool-based, home-based and market-based care. The preschool-based form of care is the most common and is delivered through public and private schools which are either stand-alone or attached to a primary school. The public pre-primary school is usually a community-owned and managed venture which follows a curriculum designed by the government. Private pre-primary schools vary from informal low-cost neighborhood ECDE centres owned and run by parents or private individuals (referred to as Alternative Provision of Basic Education and Training [APBET] centres) to formal high cost private centres operated by education entrepreneurs, non-governmental organizations (NGOs) or other institutions such as religious organizations. Private pre-primary schools may follow the government curriculum, or the Montessori or Madrasa system of education.

Despite the benefits associated with ECDE, many children in Kenya do not receive quality ECDE services (Hungi, 2011), a situation blamed on insufficient government involvement in this sector. The Kenya 2014 school census data reveal that gross and net enrolment at ECDE level stand at 73.6% and 71.8%, respectively (Ministry of Education, 2015). More often than not, public preschools are characterized by inadequate play and learning materials, shortage of trained teachers, and lack of health and nutrition services. Moreover, in most of these schools, the traditional teacher-centred methodology which stresses on memorization

and recitation illustrates the heavy focus on academic preparation with little emphasis on development and acquisition of social and emotional skills (Kariuki, Chepchieng, Mbugua, & Ngumi, 2007). The lack of relevant content and inconsistencies in the curriculum also create problems for this sector.

The introduction of free primary education in Kenya in 2003 led to a concomitant increase in the number of children attending school. One unintended impact of the implementation of this policy was the decreasing enrolment observed in public- and community-owned ECDE centres (UNESCO, 2006). As these centres typically serve poorer children, their parents chose to withdraw them from school for various reasons including deciding to keep them at home until they attained primary school age while arguing that ECDE should also be free. With devolution in 2010, ECDE services were placed under the jurisdiction of County Governments (Republic of Kenya, 2010) which are now expected to ensure better quality ECDE for all children. However, the challenges observed in this sector such as poor and irregular pay for teachers and limited investment in ECDE services persist and seem to also have been 'devolved' to County Governments as they grapple with managing other sectors under their watch. There is also confusion over who should recruit and manage ECDE teachers as this function was previously managed at the national level by the Teachers' Service Commission (TSC). In addition, there is limited evidence on how well children who receive ECDE services are prepared to transition to primary school.

1.1.3 Examples of Efforts Addressing School Readiness in Kenya

In 1984, the Kenyan government, with the support of the Bernard van Leer Foundation established the National centre for Early Childhood Education (NACECE) in an effort to coordinate ECDE programmes in the country. One of the major roles of the NACECE was to train District centre for Early Childhood Education (DICECE) officers who are in turn responsible for training pre-primary school teachers in their districts through a two-year in-service training programme (Kenya Institute of Education, 2006). The DICECE officers also provide classroom support to pre-primary school teachers within their jurisdiction. Expansion of the DICECE training programme, together with an increase in ECDE training programmes provided by private organizations and universities has led to a rapid increase in the proportion of trained ECDE teachers in Kenya (Okengo, 2011).

Between 1997 and 2004, the government implemented the Kenya ECD project in 900 primary schools across 30 districts, with financial assistance from the World Bank. The main purpose of this project was to align the ECDE curriculum to the lower primary school curriculum, resulting in development of a bridge curriculum and expanded pre- and in-service training opportunities for pre-primary school teachers. The strengthening of community involvement (through provision of community support grants) as well as public-private partnerships in the ECDE sector is attributed to this project.

Other notable ECDE projects aimed at improving school readiness among pre-primary school children in Kenya include the Rapid School Readiness Initiative (RSRI) and the Madrasa Resource centre (MRC) Early Childhood Development (ECD) programme. The RSRI project was initiated by the government, in collaboration with UNICEF, shortly after the introduction of the FPE policy in 2003. The project aimed at equipping over-age children (aged 5 years and above) who had not attended pre-primary school with basic school readiness skills to enable them to join primary school and benefit from FPE (Kenya Institute of Education, 2007). The project only targeted children living in arid and semi-arid areas and excluded those from other disadvantaged settings such as urban slums and low-income rural areas.

The MRC ECD programme was initiated in the 1980s by the Aga Khan Foundation (AKF). The programme integrates regular ECDE with Islamic Religious Education (Mwaura & Marfo, 2011) and targets children from low-income Muslim households. The programme has been credited with positive gains in school readiness scores among children but is reported to be less attractive to non-Muslim parents (Mwaura, Sylva, & Malmberg, 2008).

1.2 *Tayari* Intervention Components

The *Tayari* preschool programme (*Tayari* is a Swahili word meaning "ready,") is an early childhood education (ECE) model implemented by RTI International and evaluated by the African Population and Health Research Center (APHRC). The programme, running from January 2016 to October 2017, aims to develop a cost-effective, scalable model of ECE that ensures children in Kenya aged 4-6 years are mentally, physically, socially and emotionally ready to start and succeed, in primary school. Initially, the project will work to develop a tested, cost-effective, and scalable early childhood education model to improve early reading, numeracy and executive functioning skills among children ages 4 to 6. The project will scale up incrementally, ultimately reaching children in about 1,500 ECDE centres across Kenya by 2018.

To get children to learn as they transition to primary school, the *Tayari* programme has embarked on strengthening the existing ECDE model in Kenya through: development of child-centred instructional materials; interactive teacher training and ongoing instructional coaching and support; and, a child health intervention that integrates psychosocial and health/nutrition components to support the holistic development of the child. Integrated into this work will be a technology component that will assist teachers and community-based health workers to efficiently implement the project and simultaneously conduct research on the project's impact.

The *Tayari* programme targets preschools in both public and low-cost private centres (LCPCs), also known as Alternative Provision of Basic Education and Training (APBET) centres. The programme encompasses three key features:

1. Development of a high- quality, cost-effective early learning model to help young children gain important literacy, numeracy and social-emotional skills to succeed in primary school. Activities include developing teaching and learning materials, and testing and implementing the model in both government and private pre-primary schools;

2. Independent third-party evaluation to measure the impact of the programme on children, using: a short direct assessment tool adapted from the UNICEF/UNESCO school readiness tool; assessment tools used by the APHRC and RTI; and, an adaptation of the Stallings classroom observation protocol;

3. Global advocacy to share the results and lessons learnt from Kenya's model, to inform other countries, donors, private sector providers and non-state actors, and to advance the cost-effectiveness of future early childhood education programmes.

The *Tayari* intervention comprises the following four key components:

i. DICECE training: Through this component, DICECE officers (in public centres) and instructional coaches (supporting APBET centres) are trained on the use of tablet-based technology to supervise ECDE teachers. The training will enable the officers to assess whether or not teachers are teaching in a manner that is consistent with effective pedagogical skills. The tablet-based technology provides structures for DICECE officers to give feedback on implementation of the training by teachers;

ii.   Teacher support: DICECE officers and instructional coaches provide ECDE teachers in their zones with training and support on how to improve their quality of instruction across various subjects. The training and support focuses on increasing active learning and instructional time, development of instructional materials, and utilization of books and teachers' guides.;

iii.   Books and teachers' guides: This component involves providing each learner with low-cost instructional materials on a 1:1 ratio. The activities in the learning materials are matched to the lessons, whose number will differ according to the subject. Teachers' guides developed through the *Tayari* programme are linked to the learning materials, and facilitate the teaching of the official ECDE curriculum developed by the Kenya Institute of Curriculum Development (KICD). All materials are approved by KICD;

iv.   Health support: Community Health Assistants/Volunteers (CHA/Vs) provide health support to ECDE centres to improve key health and nutrition aspects such as hand washing, latrine use and healthy eating. Rather than directly assessing the effect of the involvement of CHAs CHVs, this component will be evaluated by determining whether children exposed to health support will have better overall school readiness than their unexposed counterparts.

1.3   *Tayari* Implementation

The *Tayari* model is being implemented as a pilot project in four counties in Kenya: Siaya, Nairobi, Laikipia, and Uasin Gishu. The four counties were purposively selected by the MoEST to represent diverse backgrounds. The intervention is implemented in selected public and APBET ECDE centres within each of the four targeted counties through three treatment packages as described below:

a)   Treatment 1 (T1) intervention arm schools receive a combination of i) DICECE training; and ii) Teacher support. This treatment package focuses on training DICECE officers to support ECDE teachers more effectively. The aim of this package is to improve school readiness using the instructional materials such as big books and manipulatives and teachers' guides that are already available and currently in use ('business as usual') in pre-primary school classrooms in Kenya. Treatment 1 also provides support for teachers to develop their own materials. Treatment 1 is supported technically by the Madrasa Early Childhood Programme – Kenya (MECP-K);

b) Treatment 2 (T2) intervention arm schools receive a combination of i) DICECE training; ii) Teacher support; and iii) Books and teachers' guides provided by *Tayari*. This treatment package focuses on training DICECE officers to provide support to ECDE teachers on the use of *Tayari* instructional materials developed jointly by RTI, the MoEST and the KICD. The *Tayari* instructional materials are based on the official ECDE curriculum and include learners' books whose content is matched to teachers' guides;

c) Treatment 3 (T3) intervention arm schools receive the treatment package under (a) and (b) above (DICECE training, teacher support, books and teachers' guides provided by *Tayari*), in addition to a health support component. The purpose of the health component is to provide the knowledge required to control diseases related to hygiene practices, using the existing health services in Kenya, but linking them directly to learners in the ECDE centres. In particular, the *Tayari* health component will involve using CHVs to support health practices of ECDE centres as they relate to learners, with a goal of reducing the frequency of illnesses. It is anticipated that the reduction of illness will improve participation in the learning processes and activities among learners in ECDE centres, and thereby improve school readiness.

The geographical spread of implementation zones was determined according to resource availability. In each of the four counties, public centres within 18 zones, giving a total of 72 zones, are involved in the implementation. For APBET centres in Nairobi's urban informal settlements, 22 zones were selected. It was not feasible to randomize individuals within classrooms to different treatments; hence, centres were randomly assigned to treatment (one of the three treatment packages described earlier – T1, T2 or T3) or control group. Public centres in 54 zones and APBET centres in 16 zones have been allocated to treatment arms; public centres in 18 zones and APBET centres in 6 zones were assigned to the control arm.

Using a stepped wedge design, the intervention will be rolled out sequentially over 2 years; in 2016, the three treatments will be implemented in 27 public and 8 APBET zones with an additional similar number in 2017. By the end of 2017, 54 public and 16 APBET zones will have been exposed to the treatment. ECDE centres in these zones are the point of focus for the impact evaluation. The ECDE centres in control zones (18 public and 6 APBET) will be given the treatment at the end of the pilot phase in 2018. For implementation, it should be noted that all centres in a selected zone are given the intervention.

1.4 Purpose of the *Tayari* Programme

The *Tayari* programme aims to design, test, prove and scale new pre-primary school models that the public education system in Kenya can deliver sustainably. The external evaluation (study) seeks to assess the impact of the programme in preparing children for primary school.

1.4.1 Overall Goal of the Study

The study seeks to determine the differential impact of the three treatment packages within the *Tayari* intervention on school readiness among pre-primary school children attending ECDE centres in Kenya. The study will also establish the cost-effectiveness of the intervention. The study is not necessarily powered to detect differences among treatment groups but rather the differences between each treatment group and the control group. Similarly, the study is not powered to detect differences among the four counties.

1.4.2 Specific Objectives of the Study

The specific objectives of the external outcome evaluation are to:

1. Measure the effect of the *Tayari* programme on preparing pre-primary school children for primary school;

2. Establish which intervention packages of the *Tayari* programme work; and,

3. Assess the cost-effectiveness of the *Tayari* programme.

1.4.3 Research Questions

The outcome evaluation will answer the following main research questions:

a) What is the impact of the *Tayari* intervention packages on learners' overall achievement in specific developmental aspects such as literacy, numeracy, and executive function? In particular,

    i. Does the DICECE training & teacher support (T1) intervention package improve learner achievement?

    ii. Does the DICECE training & teacher support + books & teachers' guides (T2) intervention package improve learner achievement?

    iii. Does the DICECE training & teacher support + books & teachers' guides + health support (T3) intervention package improve learner achievement?

iv. Which *Tayari* intervention package (T1, T2 or T3) if any, has the greatest impact on learner achievement?

b) Does the effect of the treatments vary by:

i. Type of ECDE centre (public versus APBET);

ii. Length of ECDE centre exposure to the intervention;

iii. Child characteristics (i.e. age and gender);

iv. Classroom characteristics (e.g. class size, classroom interactions, baseline teaching quality, level of classroom resources); and,

v. Uptake levels/ implementation strength of the *Tayari* programme?[2]

c) Are the *Tayari* treatments cost-effective? What are the costs of each of the treatment package and their incremental effects on assessment scores?

d) Which intervention package(s) of the *Tayari* programme worked well, and what did not?

1.5 Justification of the Study

In Kenya, public and APBET ECDE centres demonstrate little evidence that they adequately prepare pre-primary school learners for school; therefore, many children join primary school without being cognitively, physically, socially and emotionally ready to start primary school. The impact evaluation reported here targets both public and APBET centres and seeks to create an evidence base for improving school readiness among pre-primary school learners.

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[2]Measuring the strength of programme implementation and assessing its association with outcomes is a promising approach to strengthen pragmatic impact evaluation, both to assess impact and to identify which aspects of a programme need to be strengthened (see for example Hargreaves et al., 2016)

2 Methodology

2.1 Study Sites

Brief descriptions of the study sites and their ECDE background information are presented in Panels A to C in Box 2.1.

Box 2.1: Brief description of each study site in their ECDE context			
Panel A: General description of each study site			
County	**Headquarters**	**Brief description**	**Main economic activity**
Laikipia	Rumuruti	- Located in the equator in the former Rift Valley Province - A cosmopolitan county and largely rural in settlement	Tourism and agriculture. The main agricultural activities include grain farming, ranching and green house horticulture
Nairobi	Nairobi city –also the capital of Kenya	- Located in the southern part of the Kenya. - Cosmopolitan and mainly urban in settlement	Community, social, personal services, professional services, and business services sector, account for 52.1% of all the income generated in the Nairobi
Siaya	Siaya	- Located in the Lake Victoria Basin and borders Lake Victoria to the South and West - Mainly rural in settlement	Crop farming and fish farming
Uasin Gishu	Eldoret	-Located in the mid-west in the former Rift Valley Province - Mainly rural in settlement	Agriculture – mainly large scale wheat and maize farming.

Panel B: Number of ECDE centres and ECDE teachers in each study site (2014) [3]

County	Number of ECDE centres			Number of ECDE teachers				
	Total	By ECDE type		Total	By ECDE type		By teacher sex	
		Public	Private		Public	Private	Male	Female
Laikipia	509	317	192	1,198	745	453	229	969
Nairobi	2,055	213	1,841	8,022	553	7,469	1,751	6,271
Siaya	894	744	150	1,926	1,494	432	237	1,689
Uasin Gishu	811	498	313	2,573	1,468	1,105	534	2,039
Kenya	40,211	24,768	15,443	114,831	66,577	48,254	26,693	88,138

Panel C: ECDE enrolment, gross enrolment rates and learner-teacher ratios (2014)

County	ECDE Learner Enrolment			GER (%)			Learner-Teacher Ratio		
	Total	By type of ECDE		Total	By learner sex		Total	By type of ECDE	
		Public	Private		Boys	Girls		Public	Private
Laikipia	31,759	22,527	9,232	79.9	82.2	77.7	26.5	30.2	20.4
Nairobi	192,770	14,793	177,977	76.2	82.3	70.5	24.0	26.8	23.8
Siaya	64,952	56,477	8,474	73.5	72.3	74.7	33.7	37.8	19.6
Uasin Gishu	58,504	39,049	19,455	60.8	62.8	58.8	22.7	26.6	17.6
Kenya	3,019,866	2,068,659	951,206	73.6	75.7	71.6	26.3	31.1	19.7

[3]Ministry of Education, 2015

2.1 Study Design

The study (for the outcome evaluation) is designed as a randomized control trial (RCT) with three treatment (T1, T2 and T3) arms and one control arm. The outcome evaluation (OE) will use primary quantitative data as well as monitoring data collected among treatment and control centres by both RTI and the process evaluation (PE) team at APHRC. The baseline study involved a cross-sectional sample of learners.

2.2.1 Target Population

The target population is both public and APBET centres in the four counties.

2.2.2 Sampling Procedures

The evaluation used independent samples from the public and APBET centres for the treatment and control groups. To determine the impact of the intervention, we expect to detect a mean effect size of 0.20 SD[4]. Based on the understanding that ECDE centres were the unit of analysis in this study, we calculated the minimum number of public ECDE centres needed to detect the desired effect size at the programme level, and catering for a 5% attrition rate to be 150[5]. These centres are distributed equally among control arm (75) and each treatment arm – 75 for T1, 75 for T2 and 75 for T3 – and spread proportionately across the 72 public zones within the four counties. This means that we need 300 public centres to detect the desired effect size. Each treatment arm is compared to the control arm.

The four counties have varying numbers of zones; we therefore used probability proportional to size (PPS) allocation method to distribute the 18 zones (for each treatment arm) among the four counties. Similarly, the PPS allocation method was used to allocate the 75 centres in each arm across the four counties. The table below shows the allocation of both zones and centres by counties and treatment arm (group). In the table, Z_{ij} represents the share of zones allocated to arm i in County j, such that i =,1,2,3,4 and j =1,2,3,4. Likewise on centres, S_{ij} represents the number of centres allocated to arm i in County j. The total number of zones and centres under arm i will be $Z_{i1}+ Z_{i2}+ Z_{i3}+ Z_{i4} =18$ and $S_{i1}+ S_{i2}+ S_{i3}+ S_{i4} =75$, respectively.

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[4] This is similar to what has been used in similar programmes e.g. PRIMR.

[5] We used Optimal Design software; see Spybrook, J., Bloom, H., Congdon, R., et al., (2011). Optimal Design Plus Empirical Evidence: Documentation for the "Optimal Design" Software. Western Michigan University.

Table 2.1: Allocation of zones and public ECDE centres by arm and county

Arm/Group (*i*)	Number of zones (*Z*)	centres per treatment (*S*)	Counties (*j*)			
			Nairobi	Uasin Gishu	Laikipia	Siaya
PT1	18	75	Z_{11}, S_{11}	Z_{12}, S_{12}	Z_{13}, S_{13}	Z_{14}, S_{14}
PT2	18	75	Z_{21}, S_{21}	Z_{22}, S_{22}	Z_{23}, S_{23}	Z_{24}, S_{24}
PT3	18	75	Z_{31}, S_{31}	Z_{32}, S_{32}	Z_{33}, S_{33}	Z_{34}, S_{34}
PC	18	75	Z_{41}, S_{41}	Z_{42}, S_{42}	Z_{43}, S_{43}	Z_{44}, S_{44}

Data are analyzed at centre level and will not be weighted due to the self-weighting resulting from the use of the PPS method. Further analysis of data at the learners' level is however weighted to adjust for the varying numbers of learners in different centres. With regards to selection of APBET centres, the same methodology was used in assigning the 22 zones in Nairobi which are under the private centre framework. This gives another 300 centres. Half of these centres (150) are for the evaluation sample of 2016 and the other half will be added to the sample in 2017. Overall, by October 2017, we expect the outcome evaluation sample to include about 9,000 learners spread across 600 public and APBET Centers, 600 ECDE teachers, and 600 head teachers/centres-in-charge in the four counties. For the 2016 baseline, 151[6] public and 147[7] APBET/private centres were involved – giving a total of 298 centres.

2.3 Survey Instruments

The study used primary quantitative data collected through ECDE centre surveys and assessments. Three quantitative survey instruments were used: a head teacher questionnaire, an ECDE teacher questionnaire and a lesson observation schedule. In addition, a direct assessment was administered to the learners.

2.3.1 Head Teacher/ECDE In-charge Questionnaire

The head teacher questionnaire was used to collect information about the centre management, enrolment, attendance, class sizes, retention, among other issues.

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[6] We expected 150, but due to rounding up of proportions for each zone, we ended up with one extra school.
[7] We expected 150, but some zones had fewer than the required number of centres. However, this will not affect the power of the analysis as we had taken into consideration a 5% attrition rate.

2.3.2 ECDE Teacher Questionnaire

The ECDE teacher questionnaire captured data on personal and professional backgrounds of teachers, class attendance, access to learning materials in the class, classroom facilities, teacher rating of learner progress in literacy, numeracy, health and nutrition knowledge and psychosocial behaviour. The information from this questionnaire complemented data obtained at the centre level.

2.3.3 Classroom Observation Protocols

An adaptation of the Stallings classroom observation protocol was used to record snapshots after every three minutes during numeracy and literacy lesson time. The adaptation involved revising items not found to be relevant to the Kenyan context and/or including items that have previously been used by the APHRC and RTI. The snapshot observations captured the teaching behaviour and teacher-learner interactions. The observations also captured various aspects of the lesson such as the use of lesson plans and learners' books.

2.3.4 Learner Direct Assessment Test

Learners were assessed using a short direct assessment tool adapted from the UNICEF/ UNESCO school readiness tool (currently referred to as Monitoring Early Learning, Quality and Outcomes – MELQO) and early grade literacy and numeracy assessment tools developed by RTI and APHRC. The adapted MELQO was reviewed by ECDE stakeholders including ECDE experts and practitioners, scholars from universities, MoEST, KNEC and KICD staff.

The adapted shorter version of the MELQO was used to assess learners' progress in literacy, numeracy, health and nutrition knowledge and psychosocial skills, as well as to provide data to measure the impact of the intervention. The adapted tool has a pool of item sets that can be equated and these sets will be administered at different times. In other words, all items will not be administered in a subsequent round of assessment. The tool was administered on a one-to-one basis and each assessment took about 15 minutes. Each assessment was preceded by an introductory 1-2-minute interaction between the assessor and the learner so that the learner could relax. In addition, a few practice items were administered before the test items to ensure that the learner understood the test requirements. Data were collected only from children who anticipated to join primary school grade 1 the following year.

2.4 Piloting of Tools

2.4.1 Training of Field Interviewers

Prior to baseline data collection, the tools were piloted in centres with similar characteristics to the evaluation centres. The pilot testing was preceded by a one-week field interviewers' (FIs) training. During the training, FIs rated interview sessions recorded on videos to ensure consistency across the FIs. The pilot testing involved 260 ECDE learners in 16 ECDE centres within Kiambu County. During the piloting exercise, senior researchers carried out spot checks to confirm that the tools were being administered according to laid-down procedures, and if the tools were working as expected. In addition, debriefing sessions were held with FIs to allow them to share their data collection experiences, and especially any concerns they might have noted during the administration of the tools. For all tools, descriptive statistics (to generate frequencies) were run on the pilot data. In addition, for the direct assessment tool, item analyses were carried out using modern Rasch measurement as well as classical test theory techniques. Information from the pilot analysis, together with that obtained from spot checks and the debriefing sessions was used to refine the tools and to inform data collection procedures, specifically with regards to administration of the tools. During piloting, we tested the time taken to administer the test using various item combinations and a 10-15-minute administration time was found to be adequate. The reliability (Cronbach's alpha = 0.96) of the test was found to be well within the acceptable range. The acceptable range is 0.70 or above.

2.5 Ethical Approval, Study Authorizations and Permissions

The protocol was submitted to APHRC's internal Scientific Review Committee on 29th September 2015, and after comments from the committee were addressed, ethical clearance was obtained from the African Medical and Research Foundation (AMREF) Ethical Review Board on 13th November, 2015. After seeking study authorization, a study permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) on 29th January, 2016. Pre-visits were made to sampled centres to inform the county education officials and head teachers about the upcoming study activities and to seek their permission.

2.5.1 Consents and Assents

The study collected data from learners who were expected to join primary school grade one in 2017, as well as from their ECDE teachers and head teachers. Maximum efforts were made to ensure that all participants were not harmed physically, emotionally, socially or in any in other way. Interviews were conducted in private and confidentiality was upheld. In order to minimize potential minor risks (e.g. upsetting a respondent), the questionnaires were designed to have skips or filters that protect the respondent from answering questions they were not comfortable with. Data sets do not have personal identifiers.

Participants were informed that there are no direct benefits to them but that the study findings are expected to benefit the community at large by improving school readiness among all pre-primary school children in Kenya. Before commencement of the interviews, participants were informed about the length of the session; their approval to continue with the interview was then sought. In addition, verbal assent was sought from learners while signed proxy informed consents were obtained from their parents, head teachers and teachers. In some cases, the head teacher, as is the norm in Kenya, gave a written statement that s/he was authorized to sign a letter of consent on behalf of the parents. This was based on our past experience where parents asked that we get a signed consent from the head teacher (Ngware et al., 2013). Signed informed consent was sought from teachers and head teachers participating in the study. Participation in the study was voluntary and even when the head teacher consented, learners were required to participate voluntarily.

In line with ethical practices, stringent procedures to uphold the fundamental principles governing research on human participants were followed. As an institutional requirement at APHRC, all the investigators have undertaken an ethics course. Field interviewers were trained and sensitized on ethical issues during data collection. Importantly, during data collection, members of the core research team carried out spot checks to ensure that research ethics are upheld and that the participants are not harmed or exposed to any risk whatsoever.

2.6 Baseline Data Collection

2.6.1 Recruitment and Training of Field Interviewers (FIs)

When recruiting field interviewers (FIs), preference was given to those who had previously participated in assessment studies, specifically, the Primary Math and Reading (PRIMR) Initiative that was implemented by RTI, and the East Africa Quality in Early Learning (EAQEL) Initiative that was implemented by APHRC; and those familiar with digital/computer technology. We also considered those who were familiar with the target counties and demonstrated fluency in the local language, as well as in Kiswahili and English. It was critical that FIs understand the target counties because of the logistics involved and the fact that data collection would involve young children.

A total of 78 FIs were trained on the meaning of the items in the instruments, best practices in the administration of the instruments, and ethical protocols to be followed during field work. They were also trained on the use of electronic data collection devices. Role plays were used to develop FIs' confidence in tool administration. Further, the FIs were exposed to hands-on training in the use of electronic data capture and procedures during pre-testing of the tools. The training was conducted over a five-day period at the APHRC premises. Consistency across raters was examined by having FIs repeatedly rate interview sessions recorded on videos.

2.6.2 Data Collection and Processing

A data capture programme was created and installed in the tablets (electronic devices that were used to collect data) with constraints for quality control to disallow out-of-range values, allow observation of the skips in the questionnaire as well as not allowing missing values where they are not expected. The data collected were verified on site and before leaving a zone by field interviewers, team leaders and research officers for accuracy and completeness. Any inconsistencies found were counter-checked with the respondent before leaving the site. To further strengthen the quality of data being collected, at least two senior researchers made spot checks during field work. The spot checks included random visits to respondents that had already been interviewed to confirm the accuracy of key information collected. The senior researchers also made random visits to the field teams during actual interviews to ensure that procedures and ethical protocols were being adhered to. In addition, field supervisors randomly counter-checked 5% of the captured data as a further quality check. The quality of the data was counter-checked by the data manager.

Once the data were collected and verified in the field, they were transmitted electronically to a central server where they were recorded automatically for accountability. Each field worker uploaded their data for the day (after the quality checks) to a central server where the data were synchronised.

After being transmitted to a central computer server, the data were cleaned for inconsistency and missing values, that is, accuracy and completeness. Cleaning was done using STATA version 12. The databases were stored in formats that allowed transfer to various analytic software tools. The descriptions included variable description (label), variable name, variable type (numeric or string), value labels and measurement level. To safeguard the participants' identity, data were kept secure at all times in a password-protected server and only members of the core research team were allowed access.

2.7 Data Analysis

We made comparisons between each of the treatment groups and the control group on outcome measures of interest including learning achievement (in literacy and numeracy), health and nutrition, and psychosocial skills at baseline. For each centre category (public and APBET), analysis was carried out at various levels of disaggregation including study sites and treatment models. These subgroup analyses were conducted to improve our understanding on the status at baseline. Within the learning areas of literacy and numeracy, we analysed the results of specific areas of competencies such as phonemic awareness, letter sound fluency, counting and number identification.

2.8 Field Experiences and Lessons Learned

In this section, we present experiences from the field, explaining what went well, what could have been done differently, and issues with data collection. A summary of what went well is presented in Box 2.2.

Box 2.2: What went well and why	
County	**Description**
Laikipia	- The schools and the teachers were cooperative. Mentioning an earlier reading project, *Tusome*, in the already established schools was a good penetration point. - Despite the long distances and waking up well before dawn, the field interviewers were punctual and showed maturity and understanding of what was expected of them. The accommodation provided to the field teams enhanced punctuality and team spirit. - Mapping the schools in advance was a worthwhile effort as it enabled the establishment of networks and advance transport arrangements could be made. We also obtained contacts of teachers which eased communication despite the poor network connectivity. - The majority of the public primary schools (nearly all with ECDE) had only one ECDE teacher teaching combined classes of baby class, nursery and pre-unit. In Laikipia County, especially in the Northern part, there were quite a number of stand-alone ECDEs given the vastness of the district most of which was characterized by sparse population. In one instance, a primary school had more than one feeder ECDE. In addition, prior information on whether an ECDE is a stand-alone unit or attached to a primary school may be important in balancing the proportion of each during sampling.
Nairobi	- Sensitization and mobilization of the County Director of Education and sub-county education officials, DICECE and schools was critical in facilitating our entry into schools as well as informing these stakeholders about our activities. - The *Tusome* project is well known and most schools consented their participation in the baseline study on the basis of being familiar with it. - Listing of schools in advance was a worthwhile exercise as it enabled easy access to schools. In addition head teachers were contacted in advance before visiting the schools. - The checklist tool that summarized what was observed in a particular school, as well as capturing general observations was very useful in reporting.
Siaya	- Advance visits to the schools and obtaining school contacts facilitated the actual data collection process. - Early arrival at the schools was important as it enabled us to alert the teachers about the activities that we were going to conduct in the schools. - Having members of the field teams who spoke the local language (*Dholuo*) was important since all the instructions to the learners were given in *Dholuo*.
Uasin Gishu	- Good reception and cooperation from the head teachers and the ECDE teachers. - The learners were responsive to the questions (only two refused to respond). - Advance visits and calls to the head teachers eased the logistics of the data collection process.

Box 2.3 presents information on what we could have done differently.

Box 2.3: What could have been done differently	
County	**Description**
Laikipia	• Linking up with the education officials and getting approval early enough. Given the field activities, it may not have been possible to follow up with respective offices. In some cases, obtaining approvals was not difficult. • Harmonizing our calendars with those of the implementers to ensure that the number of activities happening at the ECDE centre at the same time was not overwhelming. • Budgeting – given the poor roads and rains, some areas were impassable and in future we could think of budgeting for 4X4 vehicles – especially for Laikipia North (this has cost implications).
Nairobi	• Allow ample time for baseline before commencement of intervention. • Some data collection devices were faster than others. We should use the faster ones only.
Siaya	• Consider increasing the team size from 3 to 4 field interviewers so as to finish data collection in a centre well before midday (this has cost implications).

In Box 2.4, we detail issues that we had with data collection.

Box 2.4: Issues with data collection		
County	**Schools**	**Pupils/teachers**
Laikipia	One public ECDE centre in Laikipia West could not be traced and had to be dropped from the sample and another one had been listed in the wrong zone. One other public ECDE centre in Laikipia West was dropped from the study due to data quality issues.	One issue that cropped up in relation to the pupil assessments was that in one school, the person providing assistance with translation was giving the answers to the learners and hence data quality was not assured. These data were therefore not usable and the school was also dropped. Some ECDE centres had less than the required 16 learners per class and hence the target number was not achieved. With regard to the teacher questionnaire, one teacher in a school that had opened late for the first school term had not yet reported to the school.
Nairobi	No issues	Some schools had fewer leaners than the targeted 16 per class.
Siaya	In some schools the enrolment did not reach the 16 learners targeted.	No issues
Uasin Gishu	Six schools had enrollments of 15 preschoolers, one had 13 and another had 8 learners hence the targeted numbers were not achieved. Overall, this will not affect the study as the sample had factored in an additional 5% of centres to cater for unforeseen loss of sample, including attrition.	No issues

2.9 Planned and Achieved Sample Sizes

The fieldwork for the evaluation study was conducted between 11th and 28th January, 2016. Table 2.1 presents a summary of the proportion of targeted schools, pupils, teachers and head teachers reached in each county.

Table 2.2: Proportion of sample reached in each county

County	Laikipia		Nairobi		Siaya		Uasin Gishu		Total	
Field targets / Outputs	# Targeted	N (%) reached	# Targeted	N (%) reached	# Targeted	N (%) reached	# Targeted	N (%) reached	# Targeted	N (%) reached
Schools	50	47 (94.0)	174[1]	174 (100.0)	36	36 (100.0)	41	41 (100.0)	301	298 (99.0)
Learners	800	595 (74.4)	2784	2239 (80.4)	576	474 (82.3)	656	643 (98.0)	4816	3951 (82.0)
Teachers	50	47 (94.0)	174	169 (97.1)	36	36 (100.0)	41	41 (100.0)	301	293 (97.3)
IC/ HTs	50	47 (94.0)	174	170 (97.7)	36	36 (100.0)	41	41 (100.0)	301	294 (97.7)

Notes: [1]147 APBET and 27 Public

2.10 Limitations of the Study

2.10.1 Possible Attrition Bias

In this study, the RTI is using three intervention models to improve school readiness among pre-primary school children in four counties in Kenya. The John Henry effect will be expected if participants in the comparison pre-primary schools change their behaviour, voluntarily or involuntarily, because they know they are excluded from the programme (Saretsky, 1975). For instance, the ECDE centres that will not benefit from the interventions may work hard to improve their learners' school readiness in an attempt to compete with beneficiaries. However, we do not expect this to affect the impact of the intervention, as the activities involved are intensive and have cost implications which mean they are therefore not easily replicable without support. The possibility of a John Henry effect occurring is low.

2.10.2 Hawthorne Effects

Hawthorne effects will be expected if the participants modify their behaviour or an aspect of their behaviour which is being studied by virtue of the knowledge that they are under study (Landsberger, 1958). For instance, teaching styles might be motivated by the presence of the researchers in the pre-primary school classrooms. If teachers go back to their old teaching styles after the end of the intervention, then we can say that the initial change in teaching styles was just because pre-primary school teachers knew they were being studied. This is mitigated by the fact that we are observing many cases and naturally, we do not expect that most of the cases being observed will modify their behaviour. Furthermore, during the actual observation inside the classroom, the teacher may not be able to sustain modified behaviour for an entire lesson as this would disorient the learners.

2.10.3 Risks to Participation

There are no major risks to the participants; however the evaluation is likely to face some risks: 1) Contamination due to the presence of treatment and comparison schools within the same county. However, the risk is low as the *Tayari* intervention involves specific activities that have cost implications. To mitigate this, the comparison schools were sampled from different zones which had comparable characteristics to the zones with the treatment schools. Continuous collection of data on possible spill-over effects will be done and used to interpret the results of the evaluation; 2) Attrition of schools and learners due to factors beyond our control such as closure and /or migration of households outside the study site. We shall track the attrition and account for its effect during data analysis; and, 3) Low implementation strength may hinder us from detecting the impact of the intervention. We shall work closely with the implementers to assess the implementation strength and then compare this measure with the expected outcomes of the intervention. This will be done during the formative evaluation.

2.10.4 Financial Constraints

Because of financial constraints, our study did not collect data at the household level. Nevertheless, we are aware that this is a limitation because, in psychosocial and cognitive development, parents can provide useful information on any observations on changes in ability and skills of the child, for example, how the child related with the parents or siblings, intellectual capacity to analyze issues, changes in health status, general behaviour and perceptions of their environment.

3 Characteristics of Learners, Teachers and their Schools

This chapter provides information on the gender distribution of learners included in the evaluation, as well as characteristics of their teachers, head teachers, classrooms and their ECDE centres. The ECDE centres are described according to whether they are stand-alone or attached to a primary school, whether or not they have electricity, their sources of drinking water and the types of toilets in use. For teachers, information is provided on their gender and age distribution, highest level of education attained, professional qualification, training acquired, and number of years of experience in teaching. Information on highest level of education attained, professional qualifications, training in school management, years of experience and period in current ECDE centre is provided for head teachers. Classroom characteristics include language of instruction, learner-teacher ratio, availability of teaching records and teaching/learning materials and provision of textbooks. These results are presented according to centre category (public or APBET) and across treatment groups. Comparisons are made between each treatment group and the control group.

3.1 Distribution of Sampled Boys and Girls

Boys and girls were nearly equally distributed across all counties as illustrated in Figure 3.1. As learners were selected proportionate to sex and at random, this gender balance reflects the reality on the ground. This figure is derived from data presented in Appendix 3.1. As shown in Table 3.1, in public schools, the proportion of boys in T1 and T2 groups was slightly lower than that in the control group while that in the T3 group was slightly higher. In APBET centres, the proportion of boys in all three treatment groups was slightly lower than that in the control group, with the T1 group showing the biggest difference. These differences were however not significant.

Table 3.1: Gender distribution across treatment groups by centre category (public and APBET)

Treatment group	Public			APBET		
	Boys, N (%)	Girls, N (%)	Total, N	Boys, N (%)	Girls, N (%)	Total, N
Co	298 (53.0)	264 (47.0)	562	251 (53.5)	218 (46.5)	469
T1	265 (50.3)	262 (49.7)	527	233 (46.9)	264 (53.1)	497
T2	261 (50.8)	253 (49.2)	514	221 (50.9)	213 (49.1)	434
T3	270 (56.1)	211 (43.9)	481	232 (49.7)	235 (50.3)	467
Total	1094 (52.5)	990 (47.5)	2084	937 (50.2)	930 (49.8)	1867

Figure 3.1: Gender distribution across counties
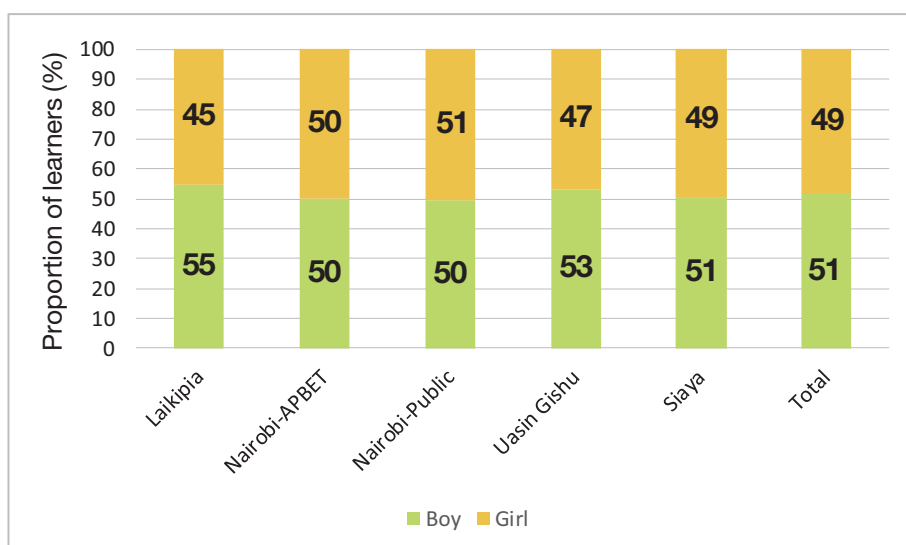
3.2 Characteristics of ECDE centres

Out of the 292[8] centres that responded to the item on affiliation to a primary school, 286 public and APBET centres had complete data on this item. The majority across all the treatment groups were attached to a primary school (Table 3.2). This trend was expected because of the government policy that encourages primary schools to have an ECDE centre in order to facilitate the smooth transition of pre-primary school children to primary grade one (also known as Standard One in Kenya).

[8]In this section, data are presented for various variables. The response (numbers) in some instances varies from variable to variable given that in a few cases, teachers and ECD heads did not respond to some of the items. The ethical guideline was clear that a respondent may not answer items they did not feel free responding to. In total, 298 centres participated in the baseline survey, out of which 292 had most of their ECDE characteristics data complete.

Tayari **Baseline Study**

Table 3.2: ECDE centre by category and affiliation to a primary school

Treatment group	Public			APBET		
	Stand-alone, N (%)	Attached, N (%)	Total, N	Stand-alone, N (%)	Attached, N (%)	Total, N
Co	1 (2.6)	38 (97.4)	39	2 (5.6)	34 (94.4)	36
T1	2 (5.4)	35 (94.6)	37	5 (15.2)	28 (84.9)	33
T2	4 (10.8)	33 (89.2)	37	4 (11.1)	32 (88.9)	36
T3	1 (2.9)	33 (97.1)	34	2 (5.9)	32 (94.1)	34
Total	8 (5.4)	139 (94.6)	147	13 (9.4)	126 (90.7)	139

As shown in Table 3.3, while less than half of the public centres across all treatment groups had working electricity, the proportion of APBET centres that had working electricity was more than 50% - and this was as per expectations because all APBET centres are located in urban areas. In the group comparisons, a higher proportion of APBET centres in the T3 group had electricity compared to the control group; however, these differences were not significant.

Figures 3.2 and 3.3 display information on the sources used for drinking water. The data from which these charts are derived are presented in Appendix 3.2. While public centres relied on piped water and water sourced from wells or boreholes, the main source of drinking water for APBET centres was piped water. Noteworthy is that within APBET centres, the majority of those in the T3 group used piped water.

Table 3.3: Availability of electricity

Treatment group	Public, N (%)			APBET, N (%)		
	Yes, working	Yes, but not working	No	Yes, working	Yes, but not working	No
Co	17 (43.6)	2 (5.1)	20 (51.3)	19 (52.8)	0	17 (47.2)
T1	17 (46.0)	4 (10.8)	16 (43.2)	18 (54.6)	2 (6.1)	13 (39.4)
T2	16 (43.2)	3 (8.1)	18 (48.7)	18 (50.0)	4 (11.1)	14 (38.9)
T3	15 (44.1)	6 (17.7)	13 (38.2)	23 (67.7)	2 (5.9)	9 (26.5)
Total	65 (44.2)	15 (10.2)	67 (45.6)	78 (56.1)	8 (5.8)	53 (38.1)

The most common type of toilets across treatment groups under public centres was pit latrines while for those under APBET centres, flush toilets were the most common. There were significantly more public centres in the T1 (p = 0.035) and T3 (p = 0.006) groups than the control group with flush toilets. Significantly more APBET centres in the T3 group than in the control group had flush toilets (p = 0.004). These results are presented in Figures 3.4 and 3.5 and the detailed data in Appendix 3.3. A point to note is that the APBET centres in the T3 group seem to have better facilities.

3.3 Characteristics of ECDE Teachers

3.3.1 Distribution of Teachers by Sex

The data in Table 3.4 show that more than 90% of the ECDE teachers across all treatment groups in both public and APBET centres were female. In the T1 and T3 groups in APBET centres, all the teachers were female. This finding was expected as teaching, especially at pre-primary levels, is traditionally considered a profession for females.

Table 3.4: Gender of the ECDE Teacher

Treatment group	Public			APBET		
	Male, N (%)	Female, N (%)	Total, N	Male, N (%)	Female, N (%)	Total, N
Co	3 (7.7)	36 (92.3)	39	1 (2.9)	34 (97.1)	35
T1	1 (2.7)	36 (97.3)	37	0	37 (100)	37
T2	2 (5.3)	36 (94.7)	38	1 (2.1)	36 (97.3)	37
T3	2 (5.6)	34 (94.4)	36	0	34 (100)	34
Total	8 (5.4)	142 (94.6)	150	2 (1.4)	141 (98.6)	143

3.3.2 Teacher Age

Table 3.5 shows the teachers' age distribution. While teachers' mean ages were fairly similar across all treatment groups within public and APBET centres, teachers in APBET centres were younger than those in public centres. Within APBET centres, teachers in the T2 group were significantly younger than those in the control group (p = 0.023).

Figure 3.2: Sources of drinking water – public centres
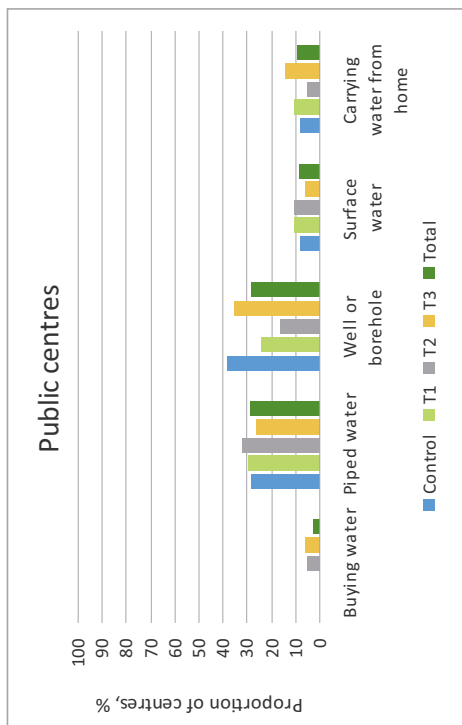
Figure 3.3: Sources of drinking water – APBET centres
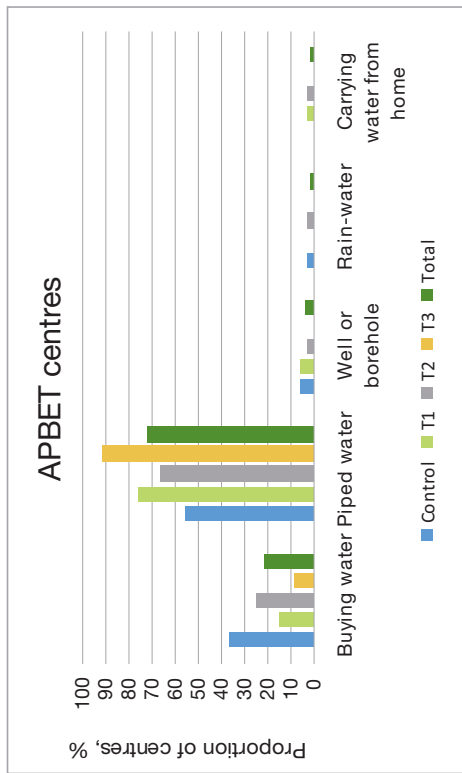
Figure 3.4: Types of toilets – public centres
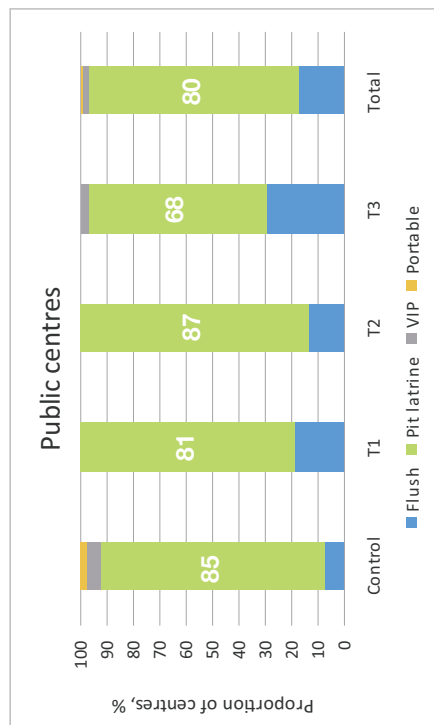
Figure 3.5: Types of toilets – APBET centres
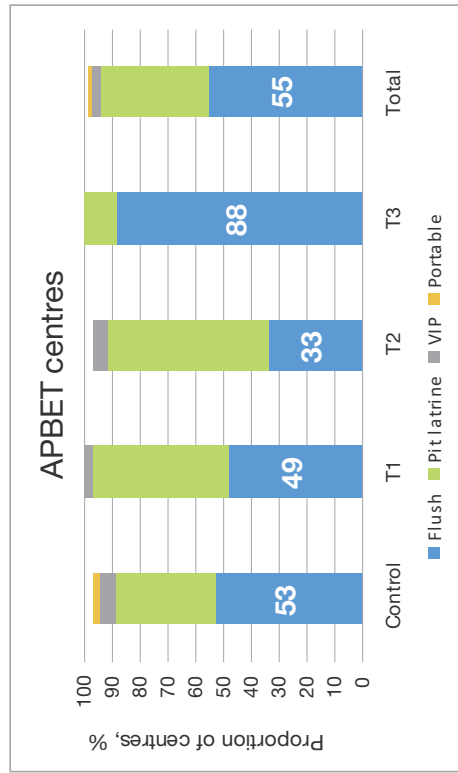
VIP = Ventilated Improved Pit Latrine

Table 3.5: ECDE Teachers' Age Distribution

Treatment group	Public (mean & SD)	APBET (mean & SD)
Co	38.6 (8.6)	32.8 (7.8)
T1	39.0 (9.5)	32.8 (9.1)
T2	39.3 (8.7)	28.8 (5.8)
T3	38.9 (8.9)	30.5 (6.6)
Total	39 (8.8)	31.2 (7.6)

3.3.3 Teacher Highest Level of Education and Professional Training

For both public and APBET centres and across all the treatment groups, the highest level of education for ECDE teachers was secondary school and college. None of the teachers in the APBET centres had attained university level education (Table 3.6).

Table 3.6: Highest Level of Education Attained - ECDE Teachers

Treatment group	Public, N (%)			APBET, N (%)		
	Primary	Sec & College	University	Primary	Sec & College	University
Co	3 (7.7)	35 (89.7)	1 (2.6)	1 (2.9)	34 (97.1)	0
T1	3 (8.1)	33 (89.2)	1 (2.7)	1 (2.7)	36 (97.3)	0
T2	2 (5.3)	35 (92.1)	1 (2.6)	0	37 (100)	0
T3	1 (2.8)	32 (88.9)	3 (8.3)	0	34 (100)	0
Total	9 (6.0)	135 (90.0)	6 (4.0)	2 (1.4)	141 (98.6)	0

As shown in Table 3.7, in both public and APBET centres and across all treatment groups, the most commonly reported professional qualification that ECDE teachers had obtained was at certificate level. However, compared to the control group, there were fewer teachers with this level of qualification in the T1 and T3 groups in public centres. In APBET centres, the proportion of teachers with certificate level training in the T2 and T3 groups was lower than that in the control group.

Table 3.7: Professional Qualifications – ECDE Teachers

Treatment group	Public, N (%)				APBET, N (%)			
	Untrained	Certificate	Diploma	Degree	Untrained	Certificate	Diploma	Degree
Co	3 (7.9)	25 (65.8)	9 (23.7)	1 (2.6)	8 (22.9)	24 (68.6)	3 (8.6)	0
T1	6 (16.2)	18 (48.7)	12 (32.4)	1 (2.7)	6 (16.2)	24 (64.9)	7 (18.9)	0
T2	5 (13.2)	25 (65.8)	7 (18.4)	1 (2.6)	10 (27.0)	17 (46.0)	10 (27.0)	0
T3	6 (16.7)	13 (36.1)	15 (41.7)	2 (5.6)	12 (35.3)	15 (44.1)	7 (20.6)	0
Total	20 (13.4)	81 (54.4)	43 (28.9)	5 (3.4)	36 (25.2)	80 (55.9)	27 (18.9)	0

Among the ECDE teachers who had some form of professional qualification (129 out of 150 in public centres and 107 out of 143 in APBET centres), the most commonly reported type of pre-service training among all treatment groups was that offered by the Kenya Institute of Curriculum Development (KICD). Other forms of training mentioned included those offered through the Montessori system, the Kenya Headmistress' Association, Teacher Training colleges and universities. In public centres, the proportion of teachers who had received the KICD training was slightly higher for the T1 and T2 groups than the control group. In APBET centres, the proportion of teachers in all the treatment groups was lower than that in the control group. Figure 3.6 illustrates these findings. Details of these data are presented in Appendix 3.4.

Figure 3.6: Pre-service Training – ECDE Teachers

Tayari Baseline Study
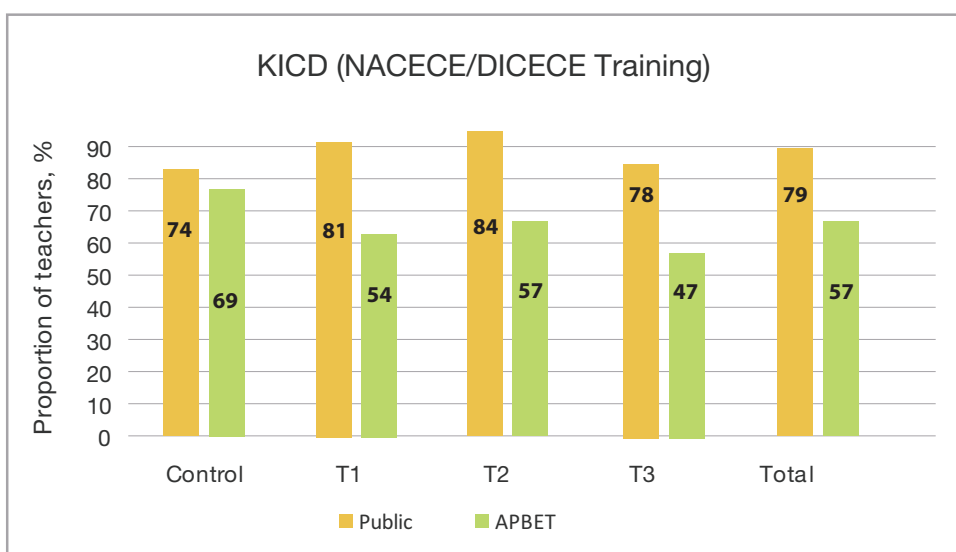
With regards to in-service training, 50% of the teachers in public centres and 40% of the teachers in APBET centres had received training offered through one of the following institutions – the Ministry of Education, Science and Technology (MoEST), RTI/*Tayari* (7% and 16% public and APBET centres, respectively), the County Government and other providers (who were not specified). However, training by RTI did not affect baseline results because it was at its initial stages at the time we collected the data. The details of this information are presented in Appendix 3.5.

3.3.4 Teacher Years of Experience

Table 3.8 presents information of teachers' experience. In public centres, teachers' mean years of experience ranged from 12.8 to 15.9 years across the four groups while in APBET centres, the mean years of experience ranged from 5.5 to 9.3 years. Although not significant ($p = 0.763$), teachers in the T3 group within public centres had on average more than two years more of experience than those in the control group. In APBET centres, teachers in the T2 group had nearly three years more of experience than those in the control group. Overall, teachers in public centres had on average two times the number of years of experience compared to those in APBET centres.

Table 3.8: ECDE Teachers' Years of Experience

Treatment group	Public (mean & SD)	APBET (mean & SD)
Co	13.5 (7.6)	6.1 (5.0)
T1	12.8 (8.8)	7.4 (5.9)
T2	13.6 (8.0)	9.3 (8.3)
T3	15.9 (15.4)	5.5 (4.8)
Total	14.0 (10.5)	7.1 (6.3)

3.4 Head Teacher Characteristics

3.4.1 Head Teacher Highest Level of Education and Professional Training

As can be seen in Table 3.9, the most commonly reported highest level of education attained by head teachers was at secondary and college level. In APBET centres, there was a significantly lower proportion of head teachers with secondary and college level of education in the TI group than in the control group ($p = 0.017$). As with the ECDE teachers, the most commonly reported level of professional qualification was at certificate level for

both public and APBET centres (Table 3.10). Compared to the control group in public centres, the proportion of head teachers who reported certificate level qualification in the T1 and T3 groups was lower. In APBET centres, the proportion of head teachers who had certificate level qualifications was higher in the T1 group than that in the control group.

Table 3.9: Highest Level of Education Attained – Head Teachers

Treatment group	Public, N (%)			APBET, N (%)		
	Primary	Sec & College	Uni	Primary	Sec & College	Uni
Co	2 (5.4)	29 (78.4)	6 (16.2)	1 (2.8)	34 (94.4)	1 (2.8)
T1	3 (7.9)	29 (76.3)	6 (15.8)	0	30 (83.3)	6 (16.7)
T2	0	32 (94.1)	2 (5.9)	0	33 (97.1)	1 (2.9)
T3	1 (2.6)	35 (89.7)	3 (7.7)	0	35 (97.2)	1 (2.8)
Total	6 (4.1)	125 (84.5)	17 (11.5)	1 (0.7)	132 (93.0)	9 (6.3)

Table 3.10: Professional Qualifications – Head Teachers

Treatment group	Public, N (%)				APBET, N (%)			
	Untrained	Certificate	Diploma	Degree	Untrained	Certificate	Diploma	Degree
Co	1 (2.6)	20 (51.3)	14 (35.9)	3 (7.7)	5 (13.9)	16 (44.4)	14 (38.9)	1 (2.8)
T1	4 (10.8)	14 (37.8)	8 (21.6)	8 (21.6)	5 (13.9)	20 (55.6)	11 (30.6)	0
T2	5 (13.2)	18 (47.4)	9 (23.7)	6 (15.8)	4 (11.1)	12 (33.3)	14 (38.0)	6 (16.7)
T3	2 (5.9)	11 (32.4)	17 (50.0)	4 (11.8)	5 (14.7)	14 (41.2)	13 (38.2)	1 (2.9)
Total	12 (8.1)	63 (42.6)	48 (32.4)	21 (14.2)	19 (13.4)	62 (43.7)	52 (36.6)	8 (5.6)

3.4.2 Head Teacher Training in School Management

Figures 3.7 and 3.8 illustrate the types of training in school management that head teachers underwent. Head teachers reported that they had received training offered through universities, the KICD, Montessori, kindergartens and primary schools. The most commonly reported source of training was the KICD which was not surprising given that the KICD is in charge of various forms of curriculum support in Kenya. In the T3 group in APBET centres, significantly fewer head teachers had received KICD training in school management compared to those in the control group (p = 0.024).

Figure 3.7: Training in School Management for Head Teachers in Public Centres
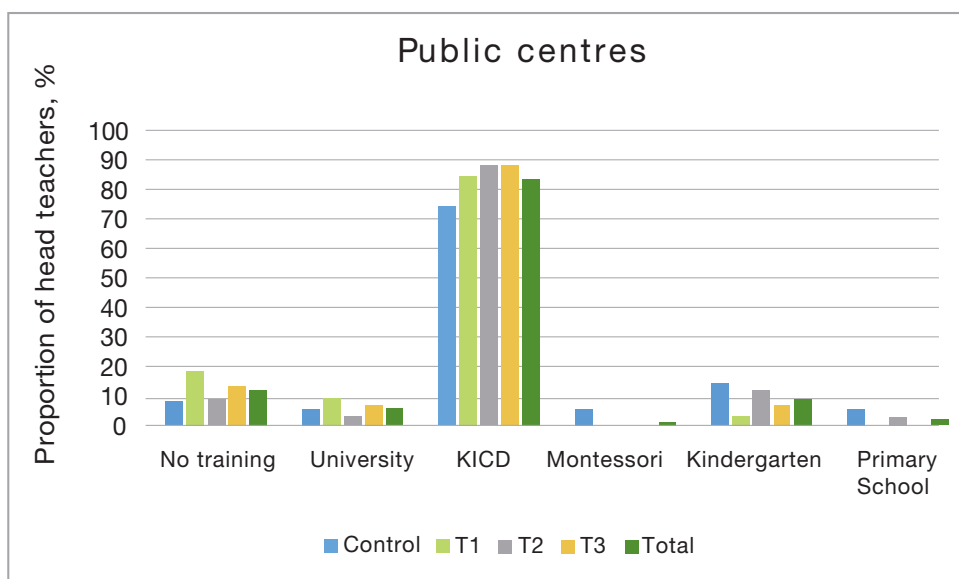
Figure 3.8: Training in School Management for Head Teachers in APBET Centres
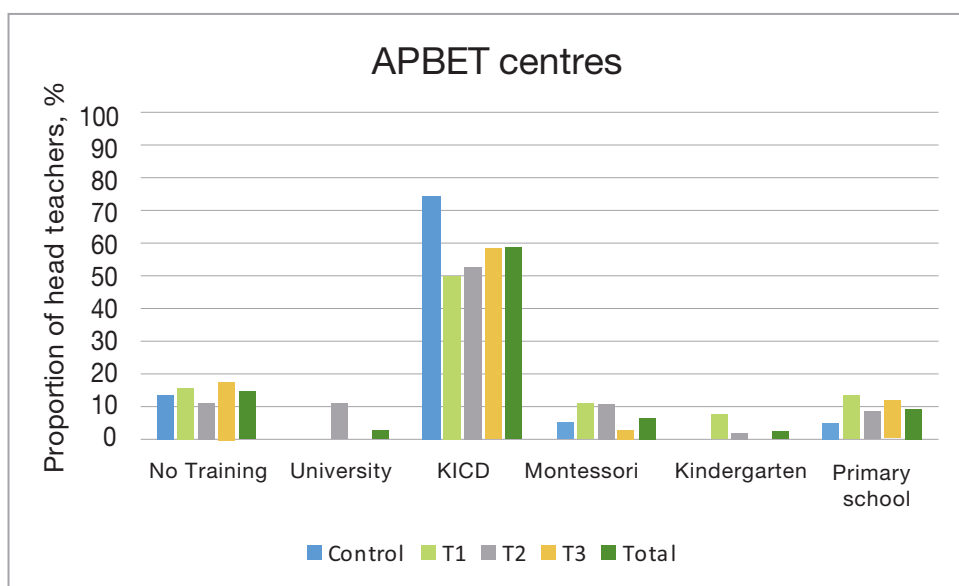
With regards to specialized training in any area of school management, a slightly higher proportion of head teachers in the T2 group in public centres had received it compared to those in the control group. For APBET centres, nearly two-thirds of the head teachers in the T3 group had received specialized training, and this proportion was higher than those in the control group (Table 3.11).

As can be seen in Table 3.12, for both public and APBET centres, a similar duration of experience for head teachers was reported across treatment groups. Overall, the head teachers in public schools reported having more years of experience than head teachers in APBET centres. The number of years that head teachers had worked in their current ECDE centres was similar across treatment groups for both public and APBET centres. Head teachers in the T3 group within both public and APBET centres had slightly more years of experience than their counterparts in the control group (Table 3.13).

Table 3.11: Specialized Training in School Management – Head Teachers

Treatment group	Public, N (%)		APBET	
	Yes	No	Yes	No
Co	11 (28.2)	28 (71.8)	20 (55.6)	16 (44.4)
T1	10 (27.0)	27 (73.0)	15 (44.1)	19 (55.9)
T2	13 (35.1)	24 (64.9)	17 (47.2)	19 (52.8)
T3	9 (26.5)	25 (73.5)	21 (63.6)	12 (36.4)
Total	43 (29.3)	104 (70.8)	73 (52.5)	66 (47.5)

Table 3.12: Head Teachers' Years of Experience

Treatment group	Public (mean & SD)	APBET (mean & SD)
Co	17.6 (9.7)	10.8 (6.9)
T1	16.0 (8.4)	12.0 (7.9)
T2	17.2 (9.5)	11.2 (7.0)
T3	18.1 (8.1)	12.6 (7.8)
Total	17.2 (8.9)	11.7 (7.4)

Table 3.13: Head Teachers' Years Worked in Current ECDE centre

Treatment group	Public (Mean & SD)	APBET (Mean & SD)
Co	9.4 (7.3)	7.2 (5.6)
T1	8.9 (7.0)	6.9 (5.2)
T2	10.3 (8.7)	6.0 (5.1)
T3	10.6 (7.6)	8.7 (6.7)
Total	9.8 (7.6)	7.2 (5.7)

3.5 Classroom Characteristics

Most centres had average class sizes ranging from 13 to 16 learners while the learner-teacher ratio was 15 to 1 in public centres, and 14 to 1 in APBET centres. Other classroom characteristics are presented in the paragraphs that follow

3.5.1 Language of Instruction

As shown in Table 3.14, in public centres, although differences were not significant, the use of mother tongue was reported more frequently among the control group than in the T1 ($p = 0.161$), T2 ($p = 0.374$) and T3 ($p = 0.407$) groups. The most commonly used language of instruction in public centres was Kiswahili while in APBET centres, the most common language was English. This finding could be explained by the location of the centres – public centres were mainly found in rural locations while APBET centres were all in Nairobi which is more metropolitan with a mix of different ethnic groups. Additionally, private schools tend to use English as parents (in both rural and urban areas) hold the perception that schools which use English as the language of instruction provide better quality education. In public centres, the use of Kiswahili was reported more frequently in the three treatment groups compared to the control group. In APBET centres, teachers in the T1 group reported the highest use of English as the language of instruction, compared to the other groups.

Treatment group	Public, N (%)			APBET, N (%)		
	Local	Kiswahili	English	Local	Kiswahili	English
Co	15 (39.5)	18 (47.4)	5 (13.2)	1 (0.7)	69 (48.3)	73 (51.1)
T1	8 (21.6)	23 (62.2)	6 (16.2)	1 (2.7)	13 (35.1)	23 (62.2)
T2	10 (26.3)	23 (60.5)	5 (13.2)	0	19 (51.4)	18 (48.7)
T3	10 (27.8)	21 (58.3)	5 (13.9)	0	20 (58.8)	14 (41.2)
Total	43 (28.9)	85 (57.1)	21 (14.1)	1 (0.7)	69 (48.3)	73 (51.1)

3.5.2 Availability of Teaching Records

Figures 3.9 and 3.10 illustrate the availability of teaching records in the centres. The types of records included lesson plans, learners' progress records, schemes of work, and records of work and health records. In public centres, a greater proportion of schools in the control group than those in the treatment groups reported the availability of lesson plans, learners' progress records and schemes of work and health records. A table detailing the availability of teaching records is found in Appendix 3.7.

3.5.3 Availability of Teaching/Learning Materials

Both public and APBET centres reported the availability of a variety of teaching/learning materials including chalkboards, different types of wall charts, painting and colouring materials, among others. The distribution of these materials as reported by teachers is presented in Figures 3.11 to 3.14. In most cases, the results show baseline balance between the study groups on these indicators.

With regards to facilities in the classroom, Figures 3.11 and 3.12 reveal that for both public and APBET centres, on average, less than 50% across all treatment groups had cupboards, shelves, libraries and tippy taps/leaky tins. This finding suggests a need for these facilities to provide storage space for books and other materials, and to promote hygienic practices.

Learning and play materials such as painting materials, indoor play materials, real objects, fixed play equipment and big books were only available in few centres across all treatment groups (Figures 3.13 and 3.14). Teachers need to be made aware of the importance of the manner in which different types of materials enable the overall development of young children.

3.5.4 Provision of Textbooks

Learners' textbooks were provided by either the school or the parent. More than half of the public centres reported that they did not provide textbooks for learners' use (Table 3.15). The proportion of public centres that did not provide textbooks in the T1 (p = 0.457) and T2 groups (p = 0.387) was higher than that in the control group while that for the T3 group (p = 0.821) was lower. For APBET centres, the proportion of schools that did not provide textbooks was higher (but not significantly different) in the control group than in the T1 (p = 0.242), T2 (p = 0.803) and T3 (p = 0.908) groups. Textbooks support the achievement of basic literacy and numeracy skills and their provision through the *Tayari* intervention has implications on the impact of the programme on learners' performance at this level.

Only eight public centres (5.4%) and 30 (21.0%) APBET centres allowed learners to carry textbooks home. These low figures could be an indication of the importance that centres place on textbooks – which could easily get lost or destroyed if learners were allowed to carry them home – or a pointer to their scarcity within these centres.

Table 3.15: Provision of Textbooks

Treatment group	Public, N (%)			APBET, N (%)		
	Yes, school provides	Yes, parent provides	No	Yes, school provides	Yes, parent provides	No
Co	17 (43.6)	3 (7.7)	19 (48.7)	15 (41.2)	4 (11.1)	17 (47.2)
T1	14 (37.8)	1 (2.7)	22 (59.5)	20 (60.6)	0	13 (39.4)
T2	14 (37.8)	0	23 (62.2)	14 (38.9)	8 (22.2)	14 (38.9)
T3	14 (41.2)	6 (17.7)	14 (41.2)	14 (41.2)	5 (14.7)	15 (44.1)
Total	59 (40.1)	10 (6.8)	78 (53.1)	63 (45.3)	17 (12.2)	59 (42.5)

Figure 3.9: Availability of Teaching Records in Public Centres
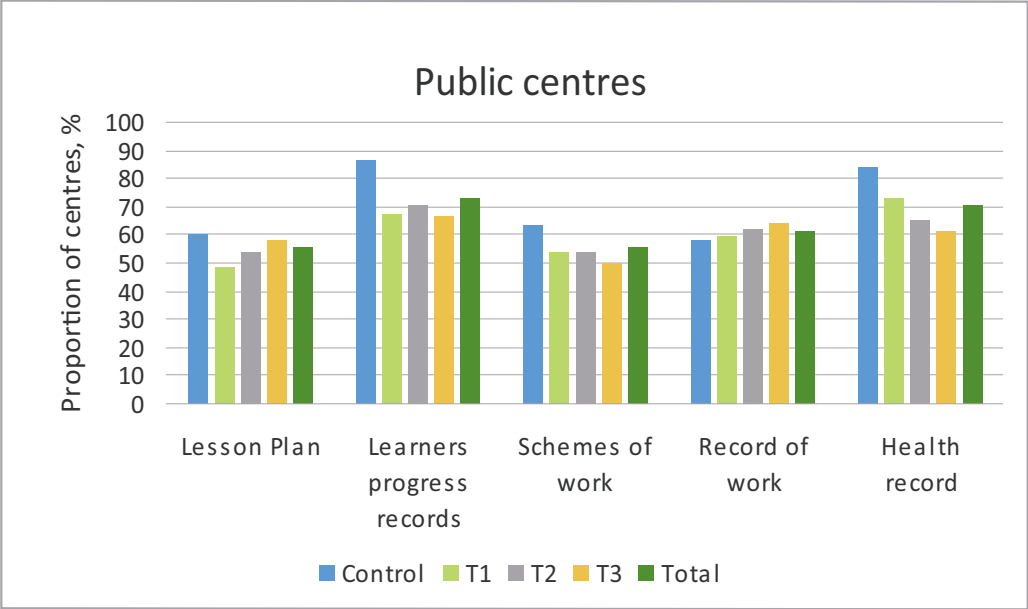
Figure 3.10: Availability of Teaching Records in APBET Centres
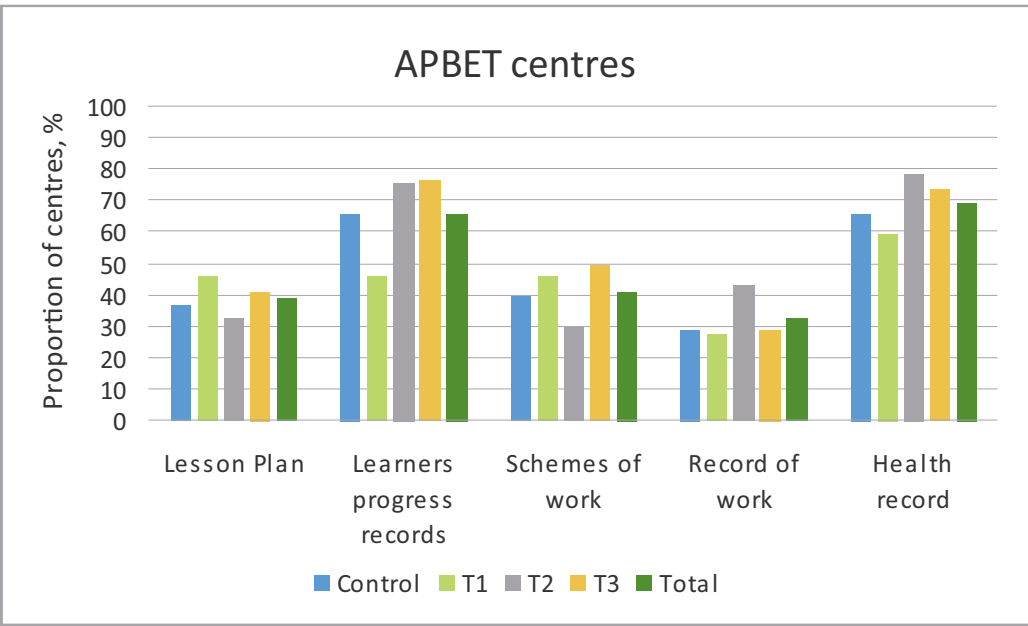
Figure 3.11: Availability of Facilities in the Classroom, Public Centres
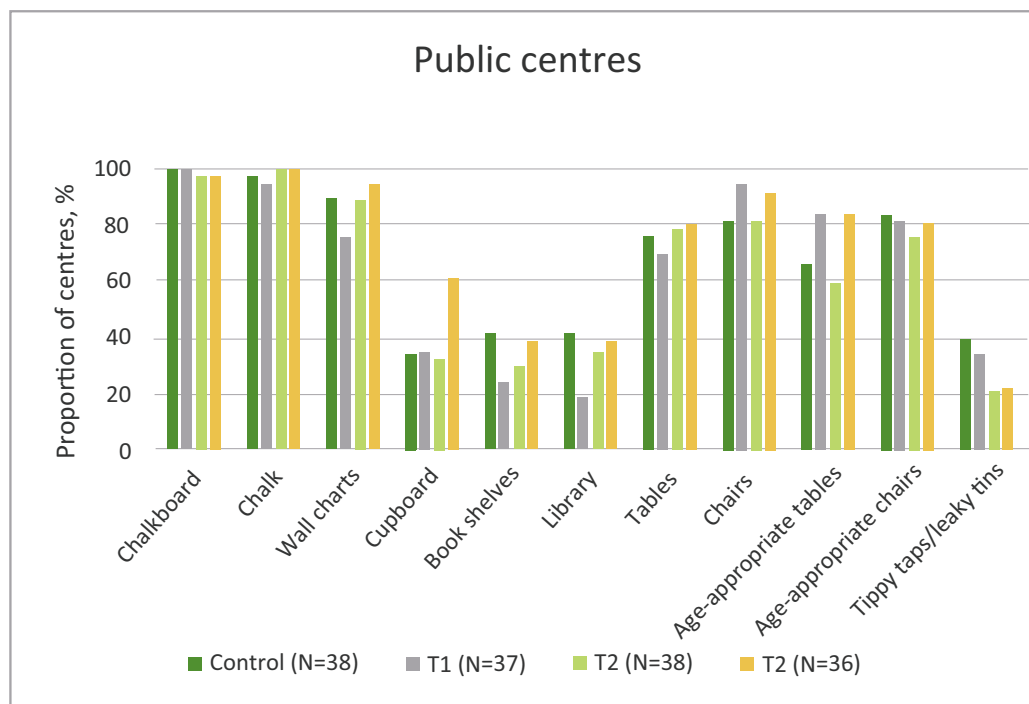
Figure 3.12: Availability of Facilities in the Classroom, APBET Centres
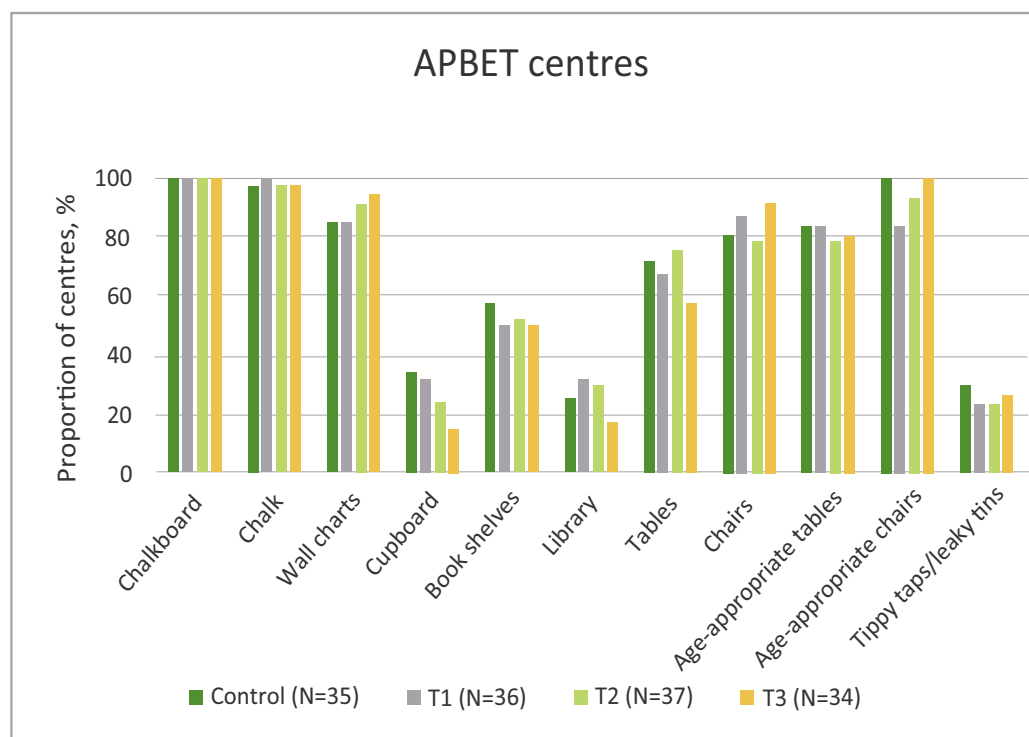
Figure 3.13: Availability of Learning/Play Materials in the Classroom, Public Centres

Public centres
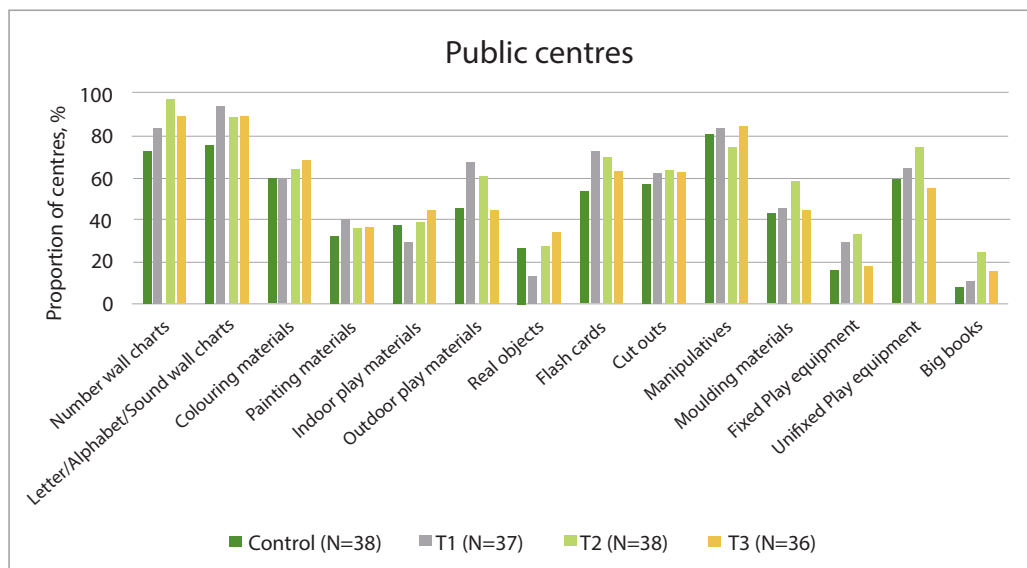
Figure 3.14: Availability of Learning/Play Materials in the Classroom, APBET Centres

APBET centres
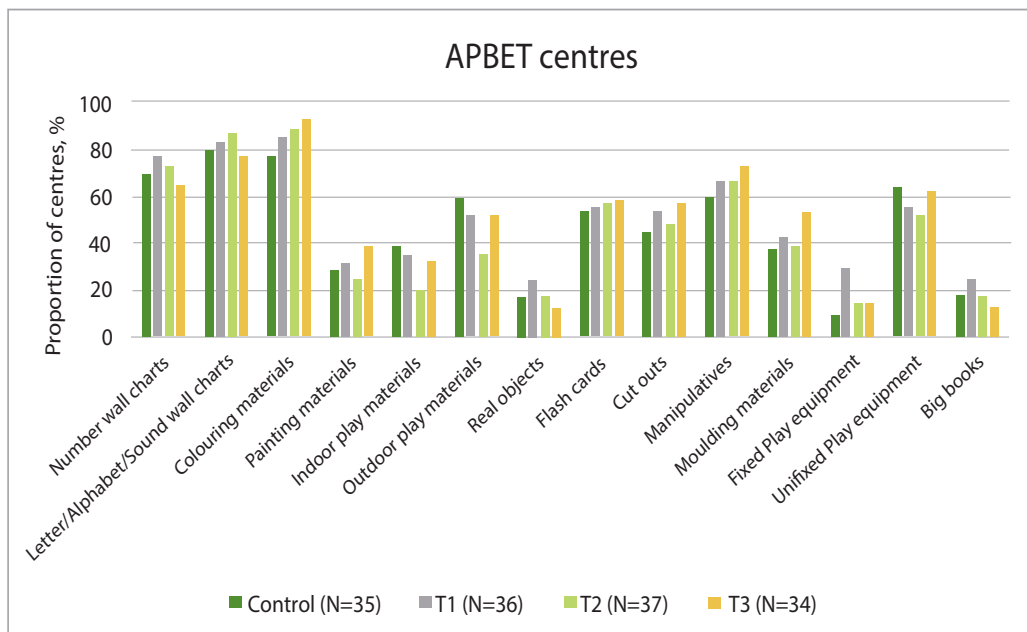
4 Learners' Achievement

This chapter covers the baseline performance of the learners on the direct assessment test. The direct assessment test had items falling into five main sub-tests namely (a) executive function, (b) psychosocial skills, (c) literacy, (d) numeracy and (e) hygiene and health. The overall direct assessment test had 89 items and most of these items assessed literacy (51 items) and numeracy (24 items) skills as shown Appendix 4.1. Items in the literacy subtest fell into five sub-domains while those in the numeracy subtest fell into six sub-domains as shown in Appendix 4.2[9]. Results presented in this chapter cover learners' scores on the Tayari school readiness index, learners' scores on the five sub-tests mentioned earlier, and learners' scores on the literacy and numeracy specific skills. The Tayari School Readiness Index is a weighted percentage score based on 10 groups of items as described in Appendix 4.2. Histograms showing distribution of the index can be found in Appendix 4.7. For each ECDE centre type (public versus APBET), comparisons are made between the respective control group and each of the three respective treatment groups. Comparisons are also made across learners' or teachers' sub-groups of interest (e.g. boys versus girls, and learners taught by male teachers versus those taught by female teachers). The main purpose of these comparisons is to examine baseline balance among various groups.

4.1 Tayari School Readiness Index by Treatment Groups and ECDE Category

Table 4.1 shows the Tayari School Readiness Index scores for learners by treatment groups and ECDE category, together with the standard errors (SE) associated with the mean scores. For each ECDE centre category, asterisks in this table denote significant differences in the comparisons made between the control group and each respective treatment group.

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[9] The item analysis is presented in Appendix 4.6

Table 4.1: Tayari School Readiness Index by Treatment Groups and ECDE Category

Treatment group	Public			APBET		
	Mean	SE	p-value	Mean	SE	p-value
Co	38.16	1.55		41.82	2.00	Ref
T1	35.74	1.93	0.330	39.18	1.71	0.32
T2	37.39	1.60	0.731	38.98	1.41	0.25
T3	35.84	1.51	0.286	41.86	2.13	0.99
Total	36.81	0.8		40.41	0.9	

For public centres, the results show that the performance of the learners in the control group on the overall direct assessment test did not differ greatly from the performance of the learners in the T1, T2 and T3 groups. On the other hand, for APBET centres, though insignificant, the T1 and T2 groups obtained slightly lower scores than the control group. The performance of learners in the control and the T3 groups was about the same.

Regardless of the ECDE category, results in Table 4.1 also show that the average Tayari readiness scores were generally low (about 37% for public and 40% for APBET) suggesting that the learners did not possess most of the skills assessed by the direct assessment test. These levels of performance mean that any learning gains made by the learners between baseline and subsequent data collection rounds can be captured with minimal risks of running into ceiling effects.

4.2   Tayari School Readiness Index by Subgroups of Interest

Figures 4.1 to 4.4 depict the learners' mean Tayari school readiness index scores by ECDE category across four background factors namely learner sex, teacher sex, teacher professional training and teacher highest level of education. The data used to plot these graphs can be found in Appendix 4.3.

The results in Figure 4.1 show that, in public centres, gender differences in the Tayari school readiness index were minimal. However, in the APBET centres, girls obtained marginally higher scores than boys. With regards to teacher sex, learners in public centres who were

taught by female teachers scored considerably higher than their counterparts who were taught by male teachers (Figure 4.2). Perhaps this is expected given that because of their young age, preschoolers might associate better with female teachers as motherly figures. Nevertheless, these results comparing female and male teachers should be interpreted with caution because they are likely to be unstable given that only a few teachers (n = 10) were male.

As expected, the mean school readiness score generally increased with teacher's level of professional training and this was more evident in public ECDE centres (Figure 4.3). Overwhelmingly, in public centres, learners who were taught by untrained teachers had significantly lower scores than those who were taught by teachers with certificate, diploma and degree level qualifications. In APBET centres, teachers with certificate and diploma professional qualifications produced similar scores for learners. A noteworthy finding is that untrained teachers produced learners with marginally higher scores than at other levels.

In public centres, learners who were taught by teachers with university level of education performed slightly better than learners who were taught by teachers with primary and secondary school levels of education. In APBET centres, teachers with primary school level of education produced higher learner scores than those with secondary school level education (Figure 4.4). This unexpected finding may be related to teaching experience - it may be that teachers with primary school education have taught at ECDE centres for a longer period although this association was not tested.

Figure 4.1: Tayari School Readiness Index by Learner Sex
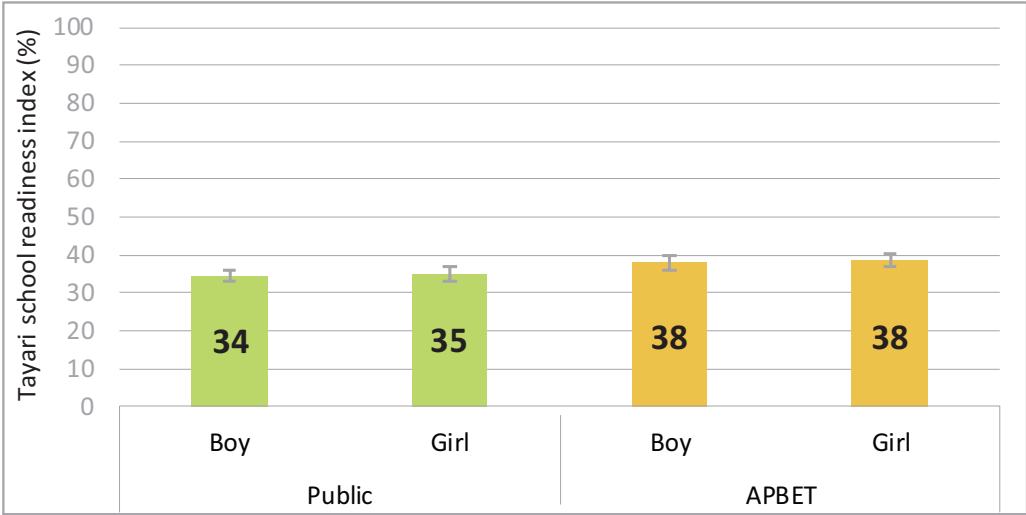
Figure 4.2: Tayari School Readiness Index by Teacher Sex
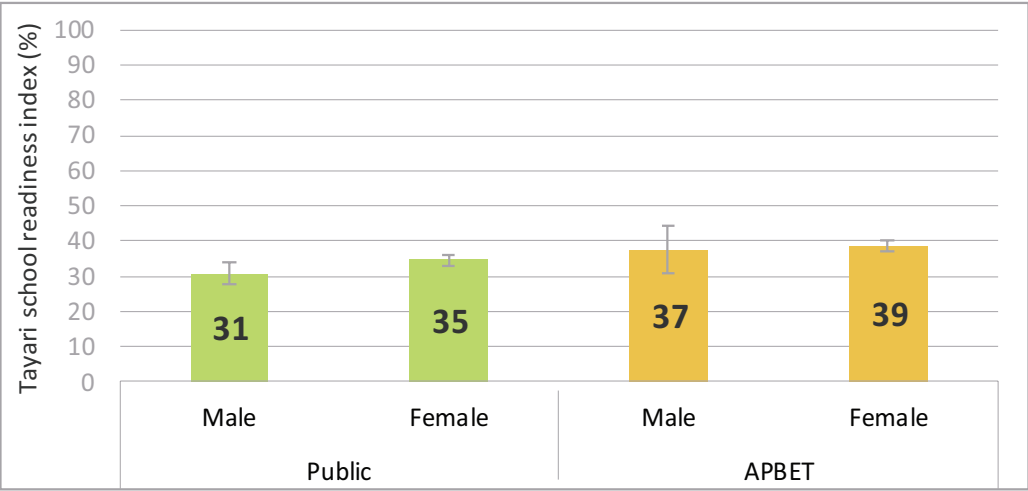
Figure 4.3 Tayari School Readiness Index by Teacher Professional Training
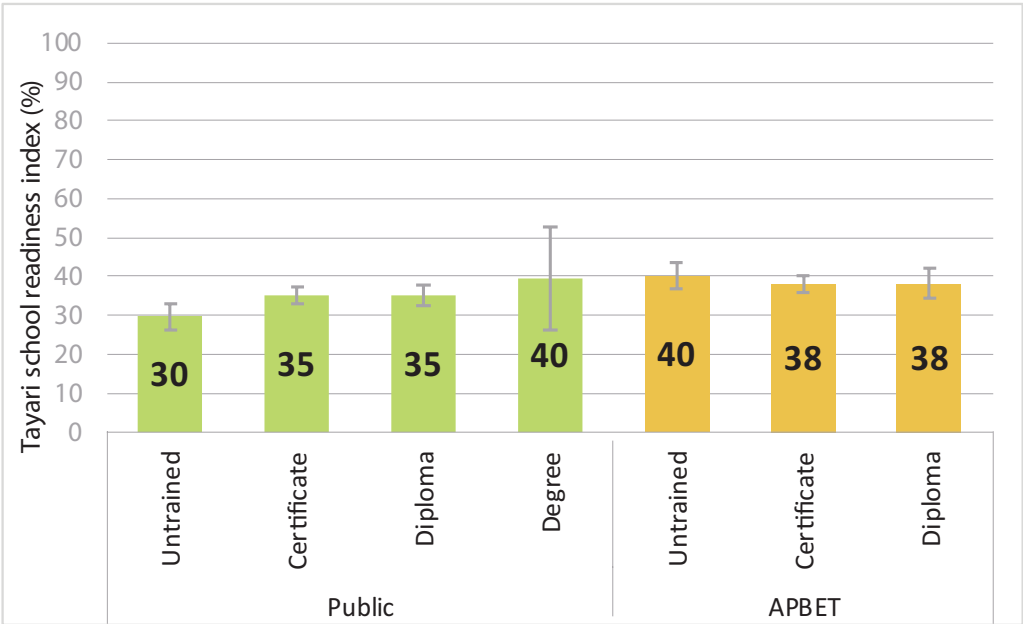
Figure 4.4: Tayari School Readiness Index by Teacher Highest Level of Education
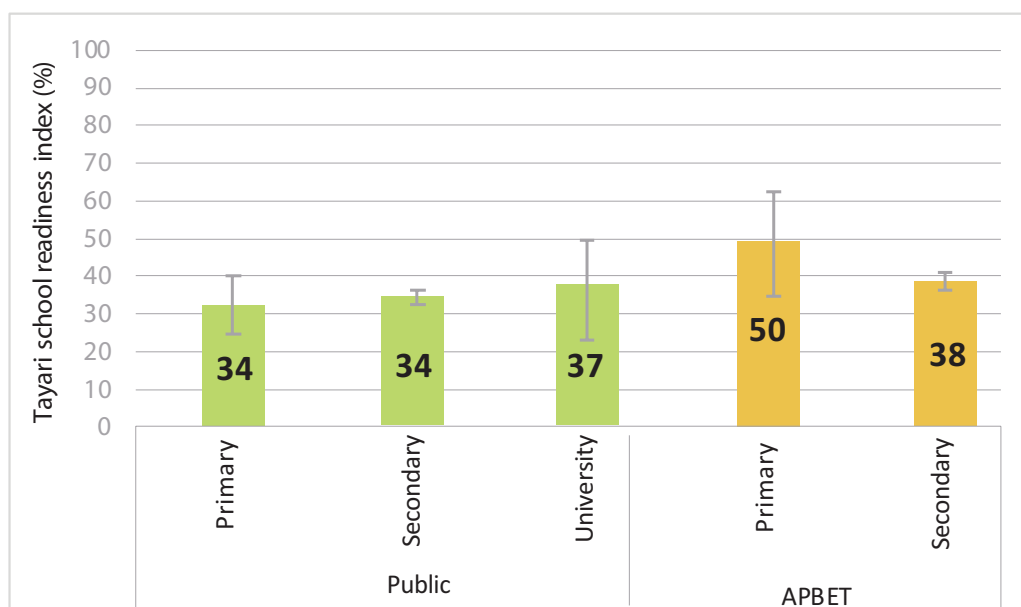
4.3 Sub-test Scores by Treatment Groups and ECDE Category

Table 4.2 shows learners' mean scores on the five sub-tests namely, executive function, psychosocial skills, literacy, numeracy and hygiene /health, which constituted the direct assessment test.

Table 4.2: Sub-test Scores (%) by Treatment Groups and ECDE Category

a) Executive function

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	5.4	0.71	5.7	0.79
T1	8.3	0.95	8.7	0.93
T2	6.4	0.87	6.2	0.89
T3	8.8	1.05	6.5	0.88
Total	7.2	0.45	6.8	0.44

b) Psychosocial skills

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	61.5	1.34	68.8	1.46
T1	56.2	1.48	62.5*	1.48
T2	55.0*	1.43	66.2	1.52
T3	59.4	1.57	66.6	1.38
Total	58	0.73	66	0.73

c) Literacy

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	29.5	0.92	34.3	1.09
T1	27.8	0.85	30.0*	1.09
T2	30.8	0.95	29.6*	1.11
T3	27	0.87	36.2	1.18
Total	28.8	0.45	32.5	0.56

d) Numeracy

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	41.1	1.05	50.7	1.21
T1	39	1.1	48.4	1.24
T2	39	1.06	47.6	1.26
T3	37.5	1.03	52.8	1.23
Total	39.2	0.53	49.9	0.62

e) Health & hygiene

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	69.5	1.26	64.9	1.37
T1	67.2	1.37	66.7	1.39
T2	67.6	1.4	63.8	1.37
T3	66.1	1.47	67.5	1.41
Total	67.6	0.69	65.7	0.69

Notes: *p-value < 0.1, **p-value < 0.05

For executive function, results in Table 4.2 show that, in public centres, learners in the T1 and T2 groups had slightly higher scores than those in control group while in APBET centres, learners in the T1 group outperformed their counterparts in the control group marginally. For both public and APBET centres, total mean scores for executive function were extremely low (about 7% for both public and APBET centres), meaning that that learners found items in this sub-test quite difficult. Items in this sub-test required learners to repeat digits read to them by field interviewers – first forwards then backwards – implying that the learners had to use working memory (rather than short-term memory) to solve this type of problems.

Learners in the T1 and T2 groups in public centres had marginally significant lower scores on psychosocial skills than those in the control group. In APBET centres, learners in the T1 group scored much lower than those in control group while learners in the T2 and T3 groups scored about the same as those in the control group. In contrast to the total mean scores for executive function which were quite low, total mean scores for psychosocial skills were relatively high (about 58% and 66% for public and APBET centres, respectively). Psychosocial items assessed learner's skills in understanding their own and other learners' emotions and feelings. From these results, it is evident that many learners had these psychosocial skills.

For literacy and numeracy, results show that learners in the T3 group in public centres were slightly outperformed by learners in the control group while in APBET centres, learners in the T1 and T2 groups were outperformed by those in the control group in literacy but not in numeracy. The total mean scores for literacy ranged from about 29% for public centres to about 33% for APBET centres while total mean scores for numeracy ranged from about 39% and 50% for public and APBET centres, respectively. This is interpreted to mean that a vast majority of the learners (especially those attending public centres) found literacy and numeracy items challenging.

The health and hygiene skills assessed in this test included knowledge about healthy foods and hygiene practices such as washing hands after visiting the toilet. Like psychosocial skills, results show that many learners possessed the health and hygiene skills that were assessed by this test. In both public and APBET centres, learners across all treatment groups performed at about the same level with those in control groups.

The total mean scores for the five sub-tests are depicted in Figure 4.5 for each ECDE category. Clearly, learners performed better in health/hygiene and psychosocial skills subtests, poorly in the numeracy and literacy subtests, and very poorly in the executive function subtest. Given these results, the current intervention provides an opportunity to promote executive

functioning skills during an optimal period when children are preparing to enter primary school. As executive functioning skills are related to learning achievement, this may be an effective way to enhance learning outcomes in numeracy and literacy.

Figure 4.5: Total Mean Scores (%) for the five Sub-tests by ECDE Centre Category
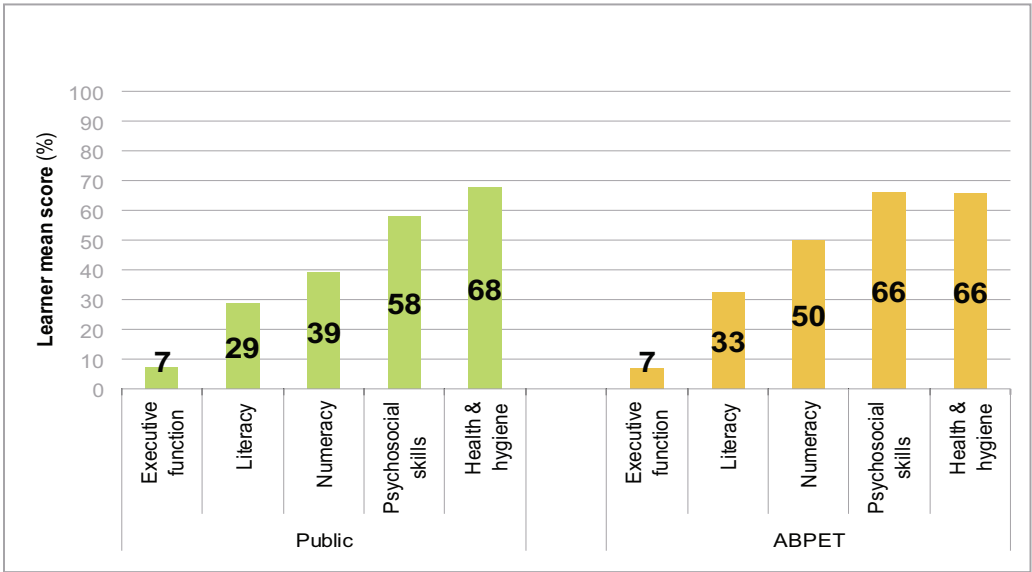
4.4 Literacy and Numeracy Sub-domain Scores by Treatment Groups and ECDE Category

Mean scores for literacy and literacy sub-domains are depicted in Figure 4.6 and Figure 4.7, respectively. The data used to plot these figures can be found in Appendix 4.4 and 4.5 for literacy and numeracy sub-domains, respectively. The main points to note regarding baseline performance of the learners in each literacy and numeracy sub-domain are outlined in Boxes 4.1 and 4.2, respectively.

Regardless of ECDE type, results show that mean scores in most literacy and numeracy domains were around 50% or below, meaning that learners have plenty of room for improvement in subsequent data collection rounds. However, performance of the learners in one literacy sub-domain (listening comprehension) and three numeracy sub-domains (quantity discrimination, measurement vocabulary, and shape identification) was good (ranging around 50-70%), meaning there is not much room for learners to improve their performance in subsequent data collection rounds.

Figure 4.6: Literacy Sub-domain Scores (%) for Public and APBET Centres

Public

	Letter sounds	Initial sound discrimination	Letter naming	Rhyme	Listening comprehension
Co	20	23	28	37	64
T1	14	14	34	35	53
T2	17	19	37	35	57
T3	12	17	31	37	50

APBET

	Letter sounds	Initial sound discrimination	Letter naming	Rhyme	Listening comprehension
Co	32	36	26	43	59
T1	30	27	23	38	59
T2	28	28	22	38	62
T3	35	34	32	39	63
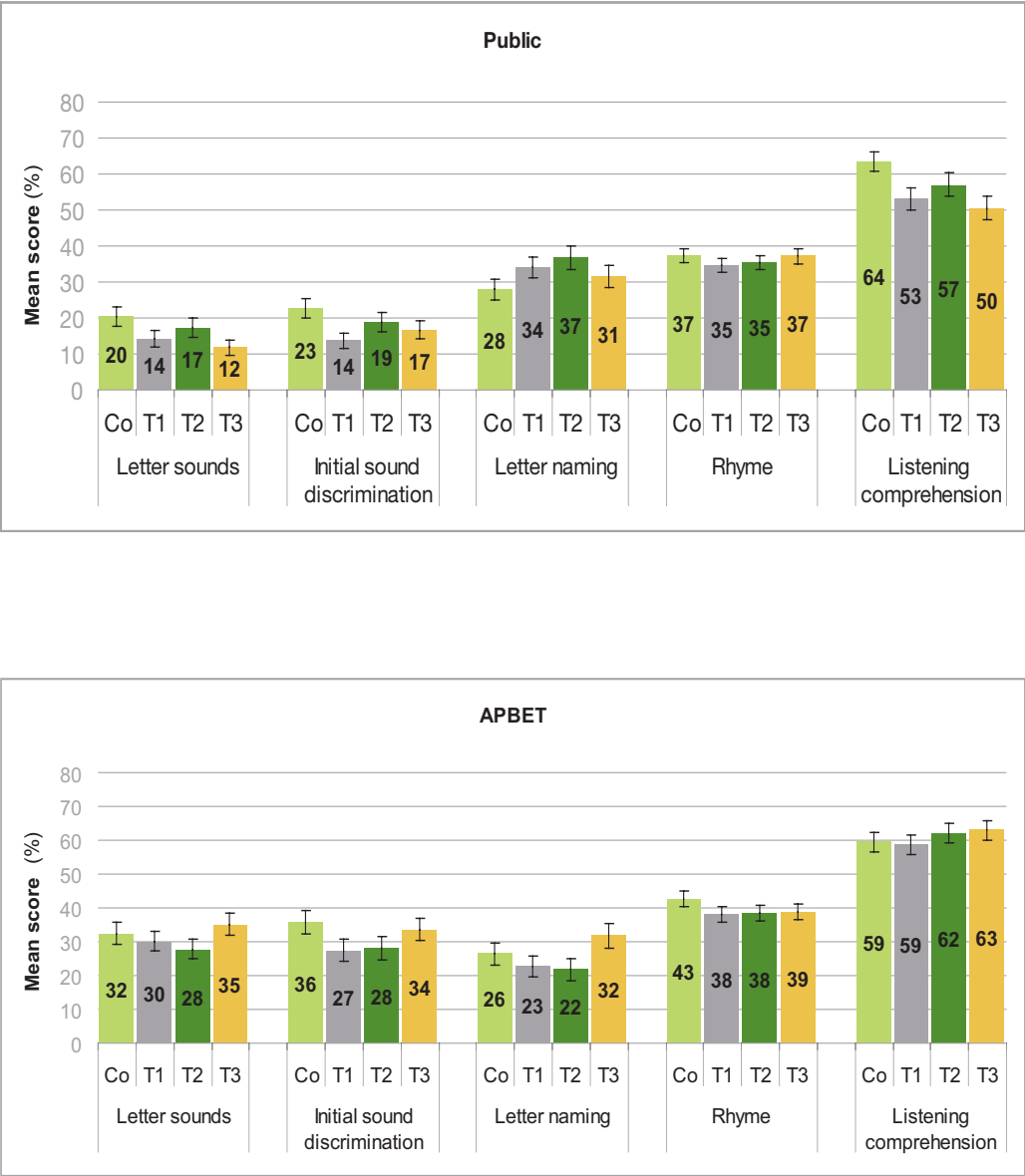
Box 4.1: Points to note Regarding Baseline Performance in the Literacy Sub-domains

Sub-domain	Public	APBET
Rhyme	Performance of learners in the control group was about the same as that of learners in three treatment groups	Learners in the T1, T2 and T3 groups had marginally significant lower scores than those in the control group
Letter naming	Learners in the T2 group performed slightly better than those in the control group	Performance of learners in the control group was about the same as that of learners in three treatment groups
Letter sounds	Learners in the T3 group performed significantly worse than their counterparts in the control group	Performance of learners in the control group was about the same as that of learners in three treatment groups
Initial sound discrimination	Learners in the T1 group had significantly lower scores than the control group.	The T1 and T2 groups performed at lower levels than the control group.
Listening comprehension	The T1 and T3 groups had significantly lower scores than the control group	Performance of learners in the control group was about the same as that of learners in the three treatment groups

Figure 4.7: Numeracy Sub-domain Scores (%) for Public and APBET Centres

Public

Number naming: Co 27, T1 24, T2 24, T3 21
Addition & subtraction using objects: Co 32, T1 34, T2 32, T3 35
Producing sets: Co 49, T1 45, T2 50, T3 42
Quantity discrimination: Co 59, T1 57, T2 59, T3 54
Measurement vocabulary: Co 62, T1 62, T2 58, T3 59
Shape identification: Co 63, T1 60, T2 60, T3 63

APBET

Number naming: Co 52, T1 46, T2 45, T3 55
Addition & subtraction using objects: Co 24, T1 29, T2 25, T3 28
Producing sets: Co 43, T1 47, T2 44, T3 47
Quantity discrimination: Co 65, T1 58, T2 61, T3 63
Measurement vocabulary: Co 52, T1 53, T2 52, T3 51
Shape identification: Co 72, T1 71, T2 72, T3 73

Box 4.2: Points to note Regarding Baseline Performance in the Numeracy Sub-domains

Sub-domain	Public	APBET
Shape identification	Performance of learners in the control group was about the same as that of learners in the three treatment groups	Performance of learners in the control group was about the same as that of learners in the three treatment groups
Number naming	Performance of learners in the control group was about the same as that of learners in the three treatment groups	Performance of learners in the control group was about the same as that of learners in the three treatment groups
Producing sets	Learners in the T3 group had marginally lower scores than their counterparts in the control group	Performance of learners in the control group was about the same as that of learners in the three treatment groups
Quantity discrimination	Performance of learners in the control group was about the same as that of learners in the three treatment groups	Learners in the T1 group had marginally lower scores than their counterparts in the control group
Addition & subtraction using objects	Performance of the learners in the control group did not differ much from that of learners in the treatment groups	Performance of learners in the control group did not differ much from that of learners in the treatment groups
Mental addition[10]	Learners in the T3 group outperformed their peers in the control group	Learners in the T1 group had higher scores than learners in the control group
Measurement vocabulary	Learners across all treatment groups had fairly similar performance levels	Learners across all treatment groups had fairly similar performance levels

[10] Results of mental addition are not shown in Figure 4.7 but they can be found in Appendix 4.5.

5 Classroom Observations

5.1 Introduction

During the baseline study, 283[11] lessons in numeracy and literacy were observed of which four did not have observations on teacher characteristics. Using an adaptation of the Stallings Observation System (SOS: Stallings, Knight, & Markham, 2014), lesson snapshots that allowed examination of classroom interactions in 3-minute intervals were recorded. The interactions were captured through four broad lesson activities including teacher focus, instructional content, teacher action and student action (see Appendix 5.1). Within each of these four broad areas, there were specific tasks to be observed during the snapshot after every three minutes from the start to the end of the lesson under observation. For example, items under teacher focus included focus on 'whole class', 'small group', 'on individual learner', 'other/teacher not focusing' and 'teacher not in the room'. Appendix 5.1 lists all the items under each of the four broad areas. From Table 5.1, of the 283 lessons, male teachers taught only ten. The observed lessons lasted between 20 and 30 minutes and the groups' average class sizes ranged from 17 to 25 students. The remainder of this chapter examines classroom interactions by the broad areas and the tasks/items in each of the broad areas across the study groups.

Table 5.1: Selected Characteristics of the Observed Classrooms

Treatment group	# of Centres	Average class size	# Teachers		# Lessons/ teachers observed	Mean lesson duration (minutes)	
			Male	Female		Numeracy	Literacy
Public							
Co	39	25.2	3	35	38	25.3	25.4
T1	37	21.11	1	36	37	26.3	26.2
T2	38	19.92	2	35	37	23.1	24.0
T3	37	20.56	2	34	36	24.3	26.3
Total	**151**	**21.7**	**8**	**140**	**148**	**24.8**	**25.5**

[11] Of the 298 centres that were visited, 15 teachers were neither observed nor interviewed; hence 283 observations with complete snapshots.

APBET

Co	36	21.0	1	32	33	24.4	25.2
T1	38	20.8	0	37	37	21.4	27.6
T2	38	17.3	1	30	31	21.5	22.7
T3	35	20.7	0	34	34	24.5	25.7
Total	**147**	**19.9**	**2**	**133**	**135**	**22.9**	**25.4**

5.2 Numeracy Classroom Interactions

Tables 5.2 and 5.3 present a summary of the snapshots for the broad areas that provided opportunities for teacher-pupil interactions inside numeracy classrooms in public and APBET pre-primary schools, respectively. These included teacher focus, instructional content, teacher action and student action. During a snapshot, the observer recorded the specific task done by the teacher or pupil within a broad area. In the two tables (Table 5.2 for public and Table 5.3 for APBET), we use the mean proportion to show the frequency of occurrence of each task (item) across the various groups being compared. In each of the broad areas, we present the three items that took most of the numeracy lesson time, with the rest being combined under 'others.' The column headings show the group means and their standard errors, while the row headings present both the broad areas and specific tasks/items that were observed. Overall, the analysis shows very few baseline differences in numeracy lesson interactions between the treatment groups and the control group in both public and APBET pre-primary schools.

5.2.1 Teacher Focus

Under 'teacher focus', the teacher was involved in providing instructions to either the whole class, small group or individual learners. The teacher may also have been on other tasks, not focusing or was not in the classroom. **Across all the study groups in public centres, whole class teaching was the dominant teaching approach and it took more than half of the lesson time under the 'teacher focus'. The proportion of time spent on whole class approach was lowest in T2 (52.93%) and highest in the control group (63.63%). Teacher-centred approaches are not known to be effective in scaffolding or in making learners read or do numeracy better** (Hardman et al., 2009). In public pre-primary school numeracy lessons, of all the time teachers spent focusing on what was happening in the classroom, almost two-thirds was used to focus on the whole class. On the other hand, of all the time students had to take any action while the lesson was ongoing, about 10% was spent on individual desk work and less than 2% in small group work – implying very little time to work independently or cooperatively. A similar pattern was observed in literacy as well as in APBET centres as shall be seen in the subsections that follow.

In public pre-primary schools, the proportion of time spent on each of the individual items under the 'teacher focus' did not statistically differ between each of the treatment groups and the control group – at baseline, the 'teacher focus' among public pre-primary school teachers was similar. The pattern of time use under the 'teacher focus' activities observed in APBET was similar to that in public ECDE centres (see Table 5.3), with no statistical difference on time spent on individual activities between each of the treatment groups and control group.

5.2.2 Instructional Content

Under 'instructional content', the adapted SOS had 11 items including rote counting, number identification and addition of single digits that emerged the most dominant (see Table 5.2 for public pre-primary schools). Rote counting was the most common instructional content in the observed numeracy lessons with public preschools in the control group spending over half of time of instructional content on this item. The dominance of rote counting could be explained by the whole-class teaching approach that was found to be common and allowed the teacher to 'dictate' the instructions on what was to be counted. In public pre-primary schools, the proportion of time under 'instructional content' spent on rote counting statistically differed between T1 and C, and between T2 and C. Number identification was the second instructional activity that took most of the time under 'instructional content', with statistically significant differences being observed between T3 and C. The pattern of time use under the 'instructional content' tasks observed in APBET was similar to that in public pre-primary schools (see Table 5.3), with no statistical difference on time spent on individual tasks between each of the treatment groups and control group.

Table 5.2: Comparisons of the Proportion (%) of Numeracy Lesson Time Spent on Specific items in Public Pre-primary Schools

Item	Co		T1		T2		T3	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Teacher focus								
Whole class	63.63	4.20	55.82	4.04	52.95	3.75	61.75	4.59
One individual learner	25.37	3.88	32.29	4.21	33.39	3.62	19.86	3.69
Other/ Not focusing	5.36	1.82	4.23	1.24	5.86	1.81	6.39	1.39
Others	5.64	2.08	7.66	2.64	7.79	2.48	12.00	2.21

Instructional content								
Rote Counting	52.35	5.92	33.57**	5.46	34.66**	5.27	38.07	6.14
Number Identification	16.74	4.15	25.06	4.97	24.59	4.60	39.73**	5.76
Addition/putting together	10.64	3.41	19.79	5.11	10.59	4.34	2.65	2.14
Others[12]	20.28	4.70	21.58	4.79	30.16	5.95	19.55	4.23
Teacher action								
Monitoring	23.91	2.64	33.91	2.49	24.54	3.01	16.22	2.18
Asking question(s)	14.77	2.54	18.07	2.99	16.89	2.59	18.76	3.28
Writing on board	14.73	3.05	16.27	3.55	13.32	3.75	9.02	2.87
Others	46.59	3.90	31.74**	3.24	45.25	3.80	56.00	4.25
Student action								
Repeating/recitation	30.79	3.98	20.71	2.50	24.54	3.48	23.94	4.68
Answering question(s)	12.70	2.70	15.37	3.14	17.40	3.30	16.28	3.01
Individual desk work	8.41	2.53	16.84	4.22	6.90	1.84	9.87	3.41
Others	48.10	4.34	47.08	4.62	51.16	4.05	49.91	5.01

Notes: * p-value< 0.1, **p-value < 0.05

Asterisk implies that the mean of the treatment group is statistically different from the mean of the control group.

5.2.3 Teacher Action

Under 'teacher action', the SOS had 11 items including writing on board, asking questions and monitoring learners that were among the most dominant (see Table 5.2). Monitoring what learners were doing was the most dominant activity under 'teacher action' in public pre-primary schools. This could be explained by the assumption made by teachers during instruction whereby they think that walking around to check what learners are doing is in fact providing individual support; however it is not as they are simply monitoring. In public pre-primary schools' numeracy lessons, the other two common tasks under 'teacher action' were 'asking questions' and 'writing on the board'. The 'asking questions' was characterized by closed teacher questions, brief student responses and, often, minimal diagnostic feedback. In many instances, some of these tasks were carried out in succession. For example, the teacher would demonstrate on the chalkboard (a task under 'others'), ask a question to either find out whether the pupils have understood or as a way of engaging the learner, and then write the response on the chalkboard.

[12]There was a statistically significant difference between T1 and control group with regards to the proportion of time spent on 'other' tasks under 'teacher action.' These 'other' tasks included repeating/reciting what the teacher said, demonstrating how to carry out a task, listening to the learner, transitioning tasks, among others.

In the process, he/she would ask the learners to recite the response by way of a cued elicitation. This could be followed by individual deskwork assignments as the teacher moved around the room monitoring how the assigned task was being executed. The proportion of time under 'teacher action' spent in the other eight activities statistically differed between T1 and C in public pre-primary schools. The pattern of time use under the 'teacher action' tasks observed in APBET was similar to that in public pre-primary schools (see Table 5.3), with no statistical difference between each of the treatment groups and control group in time spent on individual activities.

Table 5.3: Comparisons of the Proportion (%) of Numeracy Lesson Time Spent on Specific items in APBET Pre-primary Schools

Item	Co		T1		T2		T3	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Teacher focus								
Whole class	61.32	4.62	52.08	4.96	60.61	4.15	61.96	4.52
One individual learner	29.35	3.89	39.03	4.38	25.77	3.70	31.05	3.86
Other/ Not focusing	3.95	1.39	5.38	1.92	6.13	1.55	4.39	1.17
Others	5.38	1.83	3.51	1.21	7.49	2.38	2.60	1.08
Instructional content								
Rote Counting	17.54	4.94	32.59	6.47	26.63	6.45	24.14	5.48
Number Identification	19.20	5.33	17.51	4.69	16.92	4.83	15.88	4.74
Addition/putting together	41.57	8.03	35.89	7.29	42.23	7.88	41.87	7.58
Others	21.70	5.62	14.01	4.20	14.22	4.25	18.11	5.49
Teacher action								
Monitoring	27.68	2.28	31.69	3.24	26.83	2.81	29.99	2.85
Asking question(s)	17.50	3.88	9.54	2.32	13.40	3.52	17.54	4.50
Writing on board	12.92	3.62	15.89	4.43	15.01	3.62	13.38	4.23
Others	41.90	4.31	42.87	4.49	44.77	4.43	39.10	5.04
Student action								
Repeating/recitation	18.46	4.36	20.16	4.17	24.70	4.86	18.15	3.96
Answering question(s)	18.93	4.13	13.42	2.80	12.94	2.42	18.78	4.42
Individual desk work	10.96	3.35	21.37	4.65	15.09	3.62	15.04	3.92
Others	51.66	5.25	45.04	4.97	47.27	5.02	48.04	4.57

5.2.4 Student Action

Under 'student action', the SOS had 12 items including recitation, answering questions and individual desk work that emerged among the most dominant in public pre-primary schools (see Table 5.2). Recitation, which emerged as the most common task under 'student action' involves cued elicitation and has been reported in classroom literature to dominate lessons in early grades and primary schools (Ackers & Hardman, 2001; Carnoy & Chisholm, 2008; Hardman et al., 2009; Ngware, Mutisya, & Oketch, 2012; Ngware, Oketch, Mutisya, & Abuya, 2010; Sorto, Marshall, Luschei, & Carnoy, 2009). This teacher-led activity has three moves—an 'initiation', usually in the form of a question from a teacher, a 'response' in which a learner attempts to respond to the question and a 'follow-up action', in which the teacher provides feedback to the learner's response in the form of praise or affirmation (Smith, Hardman, & Tooley, 2005). Though it is a directed instruction, recitation has more opportunities for student participation during the lesson. In public pre-primary schools, the proportion of time spent in each of the tasks under 'student action' did not statistically differ between each of the treatment groups and control group. The pattern of time use under the 'student action' activities observed in APBET was similar to that in public pre-primary schools (see Table 5.3), with no statistical difference on time spent on individual activities between each of the treatment groups and control group.

5.3 Literacy Classroom Interactions

Tables 5.4 and 5.5 present a summary of the snapshots for the broad areas that provided opportunities for teacher-pupil interactions inside literacy classrooms in public and APBET pre-primary schools, respectively. We follow a similar approach to that used in section 5.2 on numeracy lesson interactions. Overall, the analysis shows very few baseline differences in literacy lesson interactions between the treatment groups and the control group in both public and APBET pre-primary schools.

5.3.1 Teacher Focus

Under 'teacher focus', the teacher was involved in providing instructions to either the whole class, small group or one individual learner. The teacher may also have been on other tasks or not focusing or was not in the classroom. As was the case with numeracy lesson observations, the three specific items that took most of the time are presented, with the rest being combined under 'others'. As observed in numeracy lessons, **whole class teaching was the dominant teaching approach and it took more than half of the lesson time under the 'teacher focus' in public pre-primary schools.** The proportion of time spent on the first two common activities (whole class and focusing on one individual learner) under the teacher focus did not statistically differ between each of the treatment groups and the control group in public pre-primary schools.

However, the proportion of time the teacher spent off-task (not focusing) under 'teacher focus' in public preschools was statistically different between T3 and C. Though a similar pattern of time spent on activities under 'teacher focus' in APBET pre-primary schools was observed, there was a statistically significant difference in time spent on focusing on an individual learner, between T2 and C (see Table 5.5).

Table 5.4: Comparisons of the Proportion (%) of Literacy Lesson time Spent on Specific items in Public Pre-primary Schools

Item	Co		T1		T2		T3	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Teacher focus								
Whole class	64.57	3.63	58.39	4.22	65.60	4.34	60.73	3.94
One individual learner	25.58	3.54	27.75	4.02	24.37	3.39	24.15	3.49
Other / Not focusing	3.29	1.02	7.19	2.04	4.33	1.26	9.06**	2.89
Others	6.56	1.84	6.67	2.06	5.70	1.69	6.06	1.51
Instructional content								
Letters and letter sounds	61.51	6.22	58.58	7.06	61.65	6.31	68.63	5.46
Vocabulary (word meaning)	12.46	1.15	7.21	2.85	9.45	1.09	11.33	0.31
Reading isolated word	2.85	3.92	5.04	3.25	2.25	4.04	0.31	4.31
Others	23.18	4.81	29.16	6.08	26.65	5.20	19.74	3.75
Teacher action								
Monitoring learners	24.44	3.32	28.28	3.72	16.75	2.25	21.14	2.71
Asking questions	16.31	2.59	16.39	2.61	22.10	3.44	16.17	2.63
Reading	18.90	3.61	16.32	3.83	12.94	2.95	12.45	3.45
Others	40.35	3.93	39.02	3.30	48.20	3.05	50.24**	3.17
Student action								
Choral reading	30.43	3.57	29.10	3.34	25.72	3.65	25.24	3.13
Writing on paper	29.27	4.23	28.25	4.14	20.05	3.56	22.91	4.81
Listening to/watching	6.40	2.18	2.54	0.94	4.29	1.24	8.89	2.45
Others	33.90	3.95	40.11	4.21	49.94**	3.97	42.96	4.71

Notes: * p-value < 0.1, **p-value < 0.05

Asterisk implies that the mean of the treatment group is statistically different from the mean of the control group.

5.3.2 Instructional Content

Under 'instructional content', the adapted SOS had 15 items including letter naming and letter sounds, reading isolated words and vocabulary that emerged the most dominant (see Tables 5.4 and 5.5) for public and APBET pre-primary schools, respectively. Letter naming and letter sounds were the most common instructional content in the observed literacy lessons with all groups of public pre-primary schools spending well over half the time of instructional content on these closely related instructional activities. The dominance of letter naming and letter sounds could be explained by the fact that teaching these items provides early reading skills to learners and hence empowers them to learn. The proportion of time under 'instructional content' spent by public pre-primary schools in different study groups did not statistically differ. Teaching word meaning (vocabulary) was the second instructional activity that took most of the time under 'instructional content', in public pre-primary schools; while reading isolated words was the third most common activity. In APBET pre-primary schools, reading isolated words was the second most common 'instructional content' activity. We also observed a statistically significant difference on time spent in 'letters and letter sounds' and 'reading isolated words' between T2 and C in APBET centres (see Table 5.5).

Table 5.5: Comparisons of the Proportion (%) of Literacy Lesson time Spent on Specific items in APBET Pre-primary Schools

Item	Co		T1		T2		T3	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Teacher focus								
Whole class	71.26	4.26	59.87	3.72	59.78	5.23	67.82	4.35
One individual learner	21.59	3.67	32.64	3.04	30.34**	4.79	25.02	3.74
Other / Not focusing	4.58	1.81	4.27	1.20	6.72	1.91	5.78	1.61
Others	2.56	1.03	3.22	1.82	3.15	1.56	1.38	0.70
Instructional content								
Letters and letter sounds	64.66	6.72	68.45	5.72	40.05***	7.89	61.24	7.56
Vocabulary (word meaning)	5.75	2.61	6.76	3.30	20.41**	6.83	4.75	2.59
Reading isolated word	4.24	3.23	2.69	2.11	3.16	2.25	2.90	2.54
Others	25.35	6.37	22.09	4.76	36.37	7.02	31.11	6.62

Teacher action								
Monitoring learners	24.46	4.20	23.57	3.07	23.80	3.91	24.46	3.50
Asking questions	14.40	3.04	16.43	3.15	15.54	2.97	15.47	3.01
Reading	13.88	3.82	15.31	3.37	13.33	3.95	15.47	3.47
Others	47.26	3.54	44.70	3.29	47.33	4.63	44.61	3.62
Student action								
Choral reading	25.58	3.81	29.96	3.99	23.52	3.80	27.21	4.56
Writing on paper	22.01	4.57	29.66	4.17	21.32	4.13	25.62	4.68
Listening to/watching	8.21	3.61	2.99	1.22	5.48	1.98	6.11	2.13
Others	44.20	4.57	37.39	3.94	49.68	5.06	41.05	5.06

Notes: * p-value < 0.1, ** p-value < 0.05; p-value < 0.01

Asterisk implies that the mean of the treatment group is statistically different from the mean of the control group.

5.3.3 Teacher Action

Under 'teacher action', the SOS had 11 items including monitoring learners while on-task, asking questions and reading that emerged among the most dominant (see Tables 5.4 & 5.5) – similar to what we saw in numeracy. Monitoring what learners were doing was the most dominant activity under 'teacher action' in literacy lessons in both public and APBET pre-primary schools. The other two common activities under 'teacher action' were 'asking questions' and 'reading' in that order for public schools, and vice versa for APBET centres. In public pre-primary schools, the proportion of time under 'teacher action' spent in the other eight activities statistically differed between T3 and C; in APBET centres there was no statistical difference in any of the items between each of the treatment groups and control.

5.3.4 Student Action

Under 'student action', the SOS had 13 items including choral reading, writing on paper and listening/watching that emerged the most dominant (see Tables 5.4 & 5.5). Choral reading followed by writing on paper emerged the most common activity under 'student action' in public pre-primary schools, while in APBET, it was writing on paper followed by choral reading. Other than the proportion of time spent on the combined activities under 'others' in public preschools, there was no statistically significant difference on most items under 'student action' between each of the treatment groups and control group.

5.4 Language used in the Classroom

The lesson observations included recording the language used by the teacher and students to interact. This was captured during the snapshots using the SOS tool. For example, under the 'teacher action' broad area, there were specific items such as recitation or singing that had to be done in a certain language. During the snapshot, the observer noted the language the teacher used to recite or sing. Figures 5.1 and 5.2 presents the language used in numeracy lessons during 'teacher action' and 'student action,' respectively. In all study groups, teachers predominantly used English language, with public pre-primary schools having a considerable number of lessons interacting in Kiswahili and some in the local language. The language of the catchment area (or mother tongue) is recommended for instruction at this level. In APBET pre-primary schools, much fewer teachers used Kiswahili while almost none used the local language. This could be explained by the fact that all APBET centres are in Nairobi which is cosmopolitan with Kiswahili being widely spoken by local communities.

Figure 5.2 displays a similar pattern to that in Figure 5.1 indicating that teachers and students interacted in the same language. The pattern of language use during teacher and student actions in literacy lessons was similar to what is reported for numeracy lessons. Figures 5.3 and 5.4 present summaries of information on the language used by the teacher during 'teacher action' in the classroom across counties. During numeracy and literacy lessons, Siaya County reported the highest use of local language across the treatment and control groups. Nairobi County reported the highest use of English across the treatment and control groups, as well as in both numeracy and literacy lessons. As has been explained earlier, the language used in the classroom is largely determined by the location of the centres, with those located in rural areas relying heavily on the local language.

Figure 5.1: Language used by Teacher during 'Teacher Action' in Numeracy Lessons
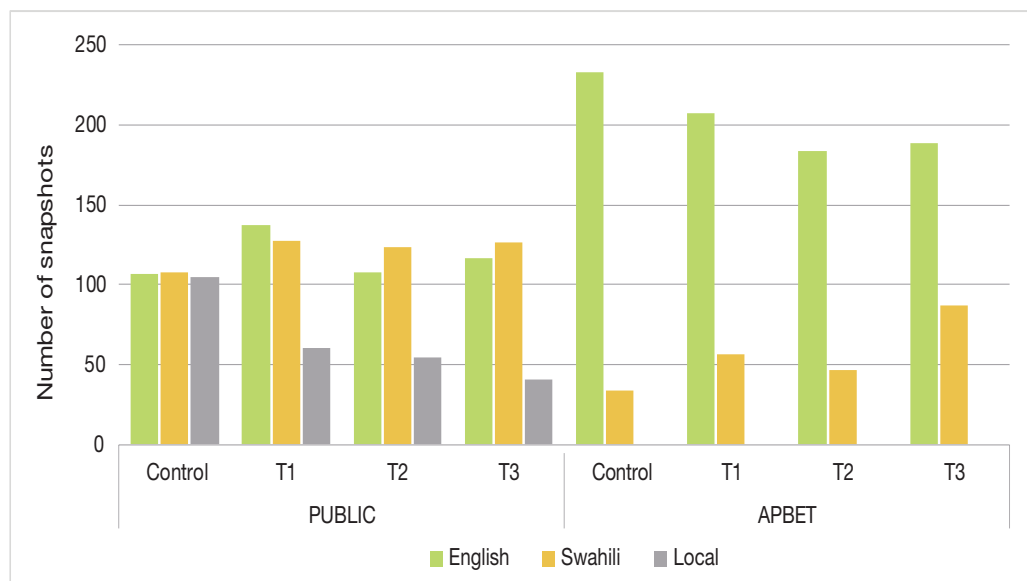
Figure 5.2: Language used by Student during 'Student action' in Numeracy Lessons
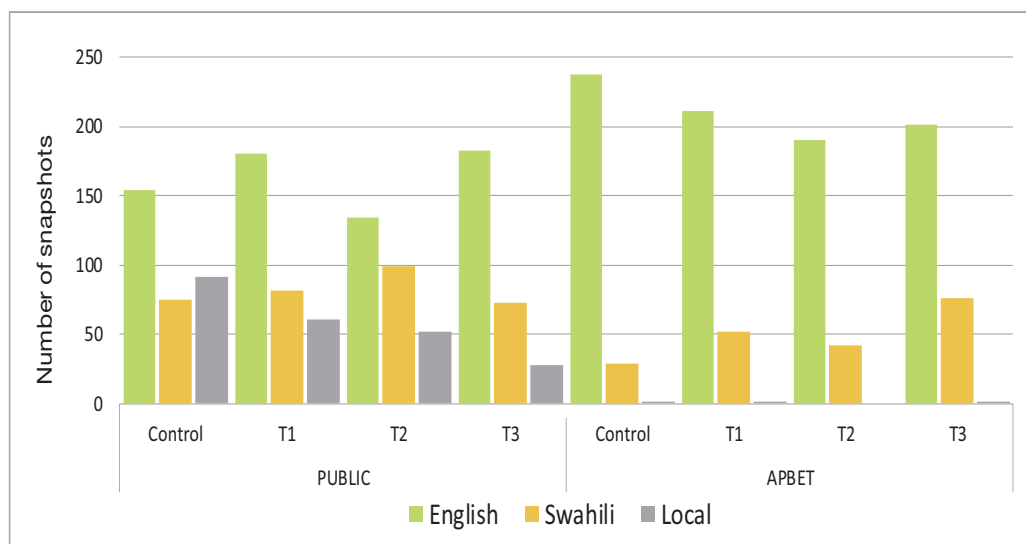
Figure 5.3: Language used by Teachers during 'Teacher action' in Numeracy Lessons by County
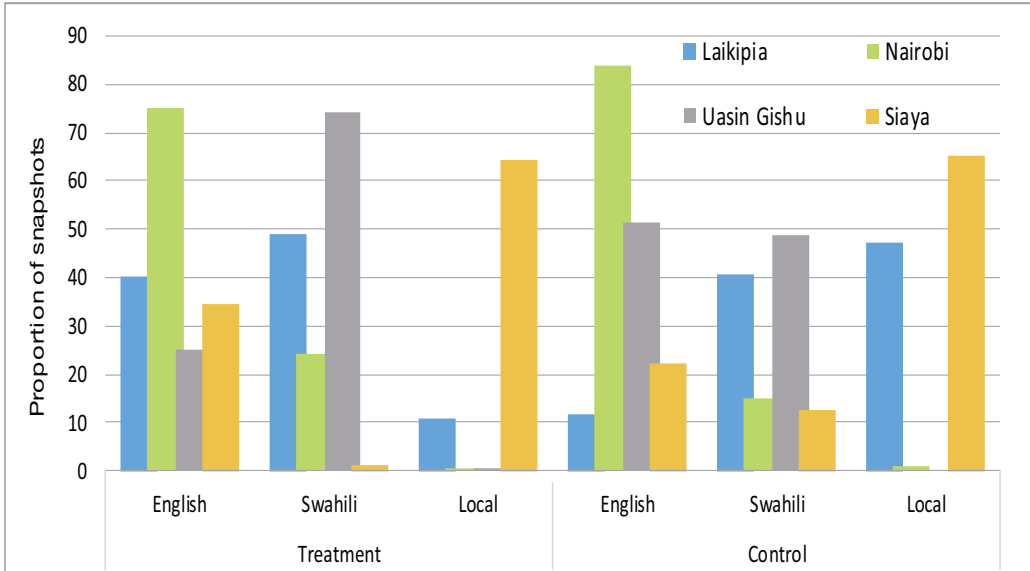
Figure 5.4: Language used by Teachers during 'Teacher Action' in Literacy Lessons by County
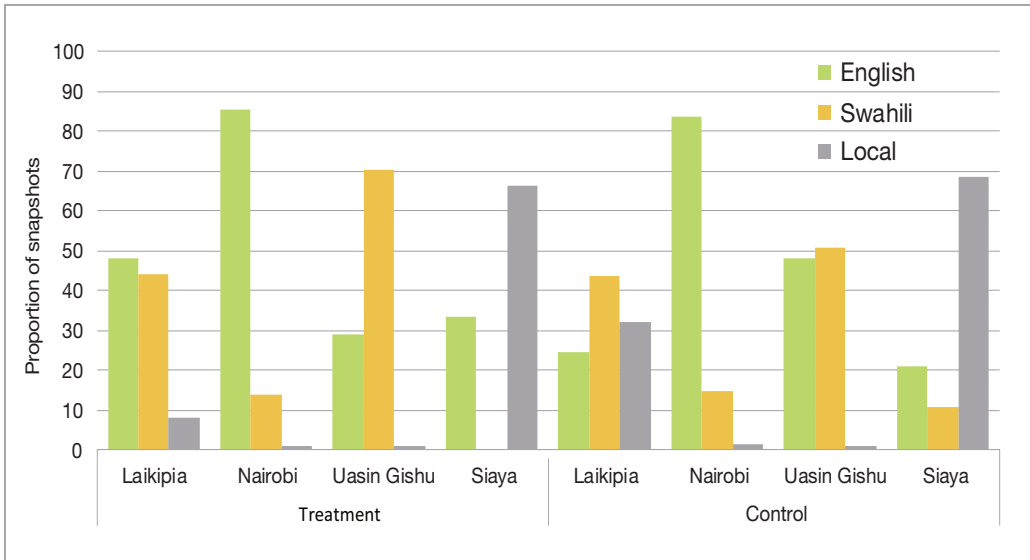
6 Summary and Conclusions

ntroduction: Children stand to benefit immensely from the early childhood development and education (ECDE) intervention programmes given that the first five years are critical for their development. In the past, ECDE programmes mainly focused on custodial care and cognitive development of young children preparing to join primary school. However, this has changed with increased awareness of the importance of ECDE, especially because there is now a large number of women with young children joining the work force. Despite the recognized benefits of ECDE, many children in Kenya do not receive quality services. To deal with this gap, there have therefore been several efforts to address school readiness in Kenya including those outlined henceforth.

The National centre for Early Childhood Education (NACECE), whose major role is to train District centre for Early Childhood Education (DICECE) officers was established in 1984 to coordinate ECDE programmes in the country. Between 1997 and 2004, the Kenya ECD project was implemented across 30 districts in Kenya with the main purpose of aligning the ECDE curriculum to the lower primary school curriculum. This project resulted in stronger community involvement as well as public-private partnerships in the ECDE sector. Other notable projects include the Madrasa Resource centre (MRC) Early Childhood Development (ECD) programme and the Rapid School Readiness Initiative (RSRI), initiated in the 1980s and 2003, respectively. The MRC ECD programme integrates regular ECDE with Islamic Religious Education and targets children from low-income Muslim households. The RSRI, targeted children living in arid and semi-arid areas aged 5 years and above who have not attended pre-primary school and aimed at equipping them with basic school readiness skills.

Because of the need to reach a wider population, as well as to ensure sustainability, the ECD programmes are being implemented by stakeholders and supported by the government. The Tayari programme, whose baseline findings are reported here, aims to develop a cost-effective scalable model of early childhood education that ensures children in Kenya aged 3 – 6 years are

mentally, physically, socially and emotionally ready to start, and succeed in primary school. The programme targets preschools in both public and low-cost private centres (LCPCs) also known as Alternative Provision of Basic Education and Training (APBET) centres. The programme encompasses the development of teaching and learning materials, and testing and implementing the model; independent third-party evaluation to measure the impact of the programme; and, global advocacy to share the results and lessons learnt from Kenya's model. The programme will be evaluated by the African Population and Health Research Center (APHRC).

The Tayari intervention comprises four key components including (i) DICECE training, (ii) teacher support, (iii) books and teachers' guides and (iv) health support. The model is being implemented in four counties in Kenya, that is, Siaya, Nairobi, Laikipia and Uasin Gishu through three treatment packages. Treatment 1 intervention arm schools will receive a combination of components (i) and (ii); Treatment 2 schools will receive a combination of components (i), (ii) and (iii). Treatment 3 schools will receive all the four components. Public centres within 18 zones in each county (bringing the total to 72 zones) and APBET centres within 22 zones in Nairobi's urban informal settlements are involved in the implementation. To detect the desired effect size of 0.20 SD, 300 public centres spread proportionately within the 72 public zones across the four counties will be required. An additional 300 APBET centres will be included in the evaluation sample. Overall, the outcome evaluation sample will include 9,000 learners spread across 600 public and APBET centres, 600 ECDE teachers and 600 head teachers from the four counties. The intervention will be rolled out sequentially over 2 years.

The evaluation seeks to establish the following: the impact of the Tayari intervention packages on learners' overall achievement in specific developmental aspects; whether the effect of the treatment varies by different factors; and, whether the Tayari treatments are cost effective.

Methods: The study is designed as a randomized control trial (RCT) with three treatment arms (T1, T2 and T3) and one control arm. The baseline study involved a cross-sectional sample which included 50% of learners and teachers in both public and APBET centres within the four counties. The evaluation will use independent samples for the treatment and control groups. Each treatment group will be compared to its respective control group.

Research and ethical clearance for the study were sought and obtained from the relevant institutions. Permission to carry out the study activities in the centres was sought from county education officials and head teachers. Signed proxy informed consents were obtained from parents, head teachers and teachers on behalf of the learners, while assent was sought from the learners themselves.

In the baseline study, we used a head teacher questionnaire, an ECDE teacher questionnaire and a lesson observation schedule to obtain information on school, teacher and learner characteristics. In addition, direct assessments were administered to the learners. Prior to baseline data collection, the tools were piloted in centres with similar characteristics to the evaluation centres. Field interviewers were trained on best practices during field work. Data were captured using tablets. The sampled centres will be followed up to late 2017.

The data collected were verified for accuracy and completeness. Spot checks were made during field work to confirm the accuracy of key information collected and to ensure that procedures and ethical protocols were adhered to. The data were then transmitted to a central computer server and cleaned using STATA version 12. Data were kept secure at all levels and were only accessible to members of the core research team. Analysis was carried out to provide comparisons between each treatment group and the control group on background characteristics, literacy and numeracy scores, health and nutrition and psychosocial skills.

Results: Boys and girls were equitably distributed across all counties. The majority of public and APBET centres across all treatment groups were attached to primary schools. Less than half of the public centres and more than 50% of the APBET centres had working electricity. While public centres relied on piped water and water from wells or boreholes, the main source of drinking water for APBET centres was piped water. The most common types of toilets in public and APBET centres were pit latrines and flush toilets, respectively. More than 90% of the ECDE teachers across all treatment groups in both public and APBET centres were female. Generally, teachers in APBET centres were younger than those in public centres. In terms of within-group comparisons, teachers in the T2 group of APBET centres were significantly younger than those in the control group. The highest level of education attained by teachers in both public and APBET centres was at secondary school and college level. Most teachers had a certificate level professional qualification, with the majority having obtained pre-service training through the Kenya Institute of Curriculum Development (KICD). Fifty percent of the teachers in public centres and 40% of the teachers in APBET centres had received in-service training through one of the following institutions – the Ministry of Education, Science and Technology (MoEST), RTI/Tayari and the County government. Teachers in public centres had on average, twice the number of years of experience as teachers in APBET centres.

For head teachers, the highest level of education attained among them was most commonly reported as secondary and college level. For head teachers in APBET centres, a significantly lower proportion in the T1 group had secondary and college level of education compared to the control group. In the T3 group in APBET centres, significantly fewer head

teachers had received KICD training in school management compared to their counterparts in the control group. Overall, head teachers in public schools reported having more years of experience than head teachers in APBET centres.

Within both public and APBET centres, most classroom sizes ranged from 13 to 16 learners, while the learner-teacher ratio was 15 to 1 in public centres, and 14 to 1 in APBET centres. The most commonly reported language of instruction in public centres was Kiswahili whereas in APBET centres, English was the most commonly used. In APBET centres, teachers in the T1 group reported a higher use of English than those in the control group. Teachers reported the availability of teaching records such as lesson plans, learners' progress records, schemes of work, records of work and health records. Both public and APBET centres also reported the availability of a range of teaching/learning materials including chalkboards, different types of wall charts and painting and colouring materials. However, a higher proportion of public centres in the T1 and T2 groups compared to the control group did not provide textbooks. In APBET centres, the proportion of schools that did not provide textbooks was higher in the control group than in the three treatment groups. Very few centres (5.4% public and 21.0% APBET) allowed learners to carry textbooks home.

Tayari school readiness score: The Tayari School Readiness Index is a weighted percentage score based on 10 groups of items. In general, learners in the T1, T2 and T3 groups in public centres did not differ from those in the control group. In APBET centres, the T1 and T2 groups had lower scores than the control group but the differences in performance between these two groups and the control group were not significant.

Tayari school readiness scores by subgroups of interest: In both public and APBET centres, there were no gender differences in overall school readiness scores. Learners in public centres who were taught by female teachers obtained marginally higher scores than their counterparts taught by males. Mean school readiness scores increased with teachers' level of professional training, and more evidently in public ECDE centres. A similar trend was observed when performance was considered in terms of teachers' level of education; learners who were taught by teachers with university level of education slightly outperformed their peers who were taught by teachers with primary and secondary levels of education.

Sub-test scores: Although generally low, learners in the T1 and T2 groups in public centres had slightly higher executive function scores than those in the control group while for APBET centres, learners in the T1 group performed better than those in the control group. Learners in the T1 and T2 groups in public centres had lower scores for psychosocial skills than

the control group, and these were marginally significant. In APBET centres, learners in the T1 group had lower scores than those in the control group. On the literacy and numeracy subtests, learners in the T3 group in public centres had lower scores than the control group. Whereas learners in the T1 and T2 groups in APBET centres were outperformed by those in the control group on the literacy subtest, there were no differences in numeracy scores. Across both public and APBET centres, learners in all treatment groups performed at nearly the same level as those in the control group.

Sub-domain scores: The sub-domains for literacy were rhyme, letter naming, letter sounds, initial sound discrimination and listening comprehension. In public centres, learners in the T2 group performed slightly better on letter naming than those in the control group while for letter sounds, the T3 group performed worse. On initial sound discrimination, learners in the T1 group had poorer performance while on listening comprehension, learners in the T1 and T3 groups had lower scores than the control group. For APBET centres, compared to the control group, all three treatment groups performed worse on rhyme, and performed at similar levels on letter naming, letter sounds and listening comprehension. On initial sound discrimination, the T1 and T2 groups were worse off.

On the numeracy sub-domains of shape identification, number naming, addition and subtraction using objects and measurement vocabulary, the performance level of learners in both public and APBET centres was fairly similar across all groups (treatment and control). In public centres, differences were seen on the sub-domains of producing sets and mental addition while in APBET centres, these differences were on quantity discrimination and mental addition.

Classroom observations: An adaptation of the Stallings Observation System (SOS) was used to obtain a snapshot of classroom interactions in 283 numeracy and literacy lessons. The interactions were captured through four broad areas that included teacher focus, instructional content, teacher action and student action. Observed lessons ranged from 20 to 30 minutes duration and average class sizes were of between 17 and 25 students.

In numeracy classroom interactions in both public and APBET centres, whole class teaching was the dominant teaching approach under 'teacher focus,' taking up more than half the lesson time. In terms of 'instructional content,' rote counting was the most commonly observed activity followed by number identification. In public centres, compared to the control group, the T1 and T2 groups spent significantly less time on rote counting while the T3 group spent more than twice the amount of time on number identification. Under 'teacher action,' the most dominant activities were writing on the board, asking questions and monitoring learners. There

was a statistically significant difference between the T1 and control groups in the proportion of time that the teacher spent on other activities. The most dominant activities under 'student action' included recitation, answering questions and individual desk work. In APBET centres, there were no differences among the treatment and control groups in the time spent on the various activities.

As with numeracy, the most dominant activity under 'teacher focus' in literacy classroom interactions in both public and APBET centres was whole class teaching which took up more than half the lesson time. In public centres, teachers spent more time off-task (not focusing) in the T3 group than in the control group. In APBET centres, teachers in the T2 group spent more time than the control group focusing on individual learners. With 'instructional content,' the proportion of time spent by teachers within the different groups in public centres did not differ. In APBET centres, significant differences were observed between the T2 and the control groups in the time spent on letter and letter sounds and reading isolated words. Under 'teacher action,' activities included monitoring learners, asking questions, reading and others. Teachers in the T3 group in public centres spent more time than the control group engaged in other activities. The most common activities in 'student action' included choral reading, writing on paper and listening/watching. In the T2 group in public centres, students spent more time than the control group engaged in other activities.

In all the study groups in public centres, teachers used English and Kiswahili during numeracy lessons at nearly similar frequency. The local language was used less frequently in all the groups except the control group which used all three languages at nearly similar levels. In APBET centres, the most dominant language used by teachers was English. In both public and APBET centres, the dominant language used by students during numeracy lessons was English followed by Kiswahili. The local language was used least frequently by learners in public centres and hardly ever in APBET centres. Across counties, the highest use of local language in both treatment and control groups was reported in Siaya.

In public pre-primary school numeracy lessons, of the time teachers spent focused on classroom activities, almost two-thirds was used in teaching the 'whole class'; on the other hand, of the time students had to take any action while the lesson was ongoing, about 10% was spent on 'individual desk work' and less than 2% in 'small group work' – implying very little time to work independently and cooperatively. A similar pattern was observed in literacy as well as in APBET centres.

Conclusions: With regards to characteristics of learners, teachers and head teachers, and schools and classrooms, there were very few significant differences observed suggesting that schools across all treatment groups in both public and APBET centres were fairly similar at baseline. This baseline balance will allow for differences observed at the end of the intervention to be attributed to the intervention itself, rather than to differences in baseline characteristics. Nevertheless, though only a few significant differences were observed, these will need to be taken into account when estimating the impact of the Tayari programme. We shall assess the net impact of the intervention based on a multivariate framework which can help to control for potential confounders.

The majority of ECDE centres in both public and APBET centres were attached to primary schools which simplifies future follow-up visits as the primary schools create an 'anchor of stability' for the ECDE centres. Because the majority of teachers were female, differences in performance according to teacher sex should be interpreted with caution.

In terms of learners' performance, there were some differences in overall mean scores between some of the treatment groups and the control group in both public and APBET centres – implying that these differences will need to be taken into account when calculating the impact of the Tayari programme. In both public and APBET centres, overall performance of learners on the direct assessment test was generally low meaning that the learners did not possess a vast majority of the skills assessed by this test. This is in a way a positive finding because it means that the test can be used to measure learning gains in subsequent data collection waves without running into the risks associated with ceiling effects.

Classroom observations revealed very similar trends across groups in the time that teachers and students engaged in specific activities – implying baseline balance in teaching styles/behaviours between the treatment arms and the control arm in both public and APBET centres. In both categories of ECDE centres and across treatment and control arms, the results revealed that very little time was spent engaging in actions that would encourage learners to work independently and cooperatively. This is a good entry point for implementing changes in the way teachers engage with learners at this level. This finding is of special interest because one of the key areas of focus for the Tayari programme is to change teaching styles/behaviours.

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Appendices

Appendix 3.1: Learners' Gender Across Counties

County	Gender		Total, N
	Boys, N (%)	Girls, N (%)	
Laikipia	326 (54.8)	269 (45.2)	595
Nairobi – APBET	937 (50.2)	930 (49.8)	1867
Nairobi – Public	184 (49.5)	188 (50.5)	372
Uasin Gishu	343 (53.3)	300 (46.7)	643
Siaya	241 (50.8)	233 (49.2)	474
Total	2031 (51.4)	1920 (48.6)	3951

Appendix 3.2: Sources of Drinking Water

Water source	Public, N (%)				APBET, N (%)			
	Co	T1	T2	T3	Co	T1	T2	T3
Water vendors	0	0	2 (5.4)	2 (5.9)	13 (36.1)	5 (15.2)	9 (25.0)	3 (8.8)
Piped	11 (28.2)	11 (29.7)	12 (32.4)	9 (26.5)	20 (55.6)	25 (75.8)	24 (66.7)	31 (91.2)
Well/ borehole	15 (38.5)	9 (24.3)	6 (16.2)	12 (35.3	2 (5.6)	2 (6.1)	1 (2.8)	0
Surface water	3 (7.7)	4 (10.8)	4 (10.8)	2 (5.9)	-	-	-	-
Rain water	7 (18.0)	8 (21.6)	9 (24.3)	4 (11.8)	1 (2.8)	0	1 (2.8)	0
From home	3 (7.7)	4 (10.8)	2 (5.4)	5 (14.7)	0	1 (3.0)	1 (2.8)	0
None	0	1 (2.7)	2 (5.4)	0	-	-	-	-

Appendix 3.3: Types of Toilets

Treatment group	Public, N (%)				[1]APBET, N (%)			
	Flush	Latrine	VIP	Portable	Flush	Latrine	VIP	Portable
Co	3 (7.7)	33 (84.6)	2 (5.1)	1 (2.6)	19 (52.8)	13 (36.1)	2 (5.6)	1 (2.8)
T1	7 (18.9)	30 (81.1)	0	0	16 (48.5)	16 (48.5)	1 (3.0)	0
T2	5 (13.5)	32 (86.5)	0	0	12 (33.3)	21 (58.3)	2 (5.6)	0
T3	10 (29.4)	23 (67.7)	1 (2.9)	0	30 (88.2)	4 (11.8)	0	0
Total	25 (17.0)	118 (80.3)	3 (2.0)	1 (0.7)	77 (55.4)	54 (38.9)	5 (3.6)	1 (0.7)

[1]Within APBET centres, one centre in the control group and one centre in the T2 group had other unspecified types of toilets

Appendix 3.4: Type of Pre-service Training

Treatment group	Public, N (%)					APBET, N (%)				
	Uni	KICD	Mont.	KHA	TT	Uni	KICD	Mont.	KHA	TT
Co	1 (2.6)	28 (73.7)	0	2 (5.3)	1 (2.6)	0	24 (68.6)	1 (2.9)	0	0
T1	0	30 (81.1)	0	0	0	1 (2.7)	20 (54.1)	5 (13.5)	3 (8.1)	2 (5.4)
T2	1 (2.6)	32 (84.2)	1 (2.6)	0	0	0	21 (56.8)	3 (8.1)	1 (2.7)	0
T3	1 (2.8)	28 (77.8)	1 (2.8)	0	0	0	16 (47.1)	2 (5.9)	1 (2.9)	1 (2.9)
Total	3 (2.0)	118 (79.2)	2 (1.3)	2 (1.3)	1 (0.7)	1 (0.7)	81 (56.6)	11 (7.7)	5 (3.5)	3 (2.1)

Key: Uni = University; KICD = Kenya Institute of Curriculum Development; Mont. = Montessori; KHA = Kenya Headmistress' Association; TT = Teacher Training

Appendix 3.5: In-service Training, including if Trained in Tayari Programme

Treatment group	Public, N (%)				¹APBET, N (%)			
	MoEST	RTI	County	Others	MoEST	RTI	County	Others
Co	1 (2.6)	2 (5.3)	7 (18.4)	9 (23.7)	2 (5.7)	3 (8.6)	0	4 (11.4)
T1	5 (13.5)	1 (2.7)	7 (18.9)	2 (5.4)	2 (5.4)	8 (21.6)	3 (8.1)	7 (18.9)
T2	2 (5.4)	3 (8.1)	7 (18.9)	5 (13.5)	4 (10.8)	7 (18.9)	0	6 (16.2)
T3	4 (11.1)	4 (11.1)	9 (25.0)	6 (16.7)	0	5 (14.7)	0	6 (17.7)
Total	12 (8.1)	10 (6.8)	30 (20.3)	22 (14.9)	8 (5.6)	23 (16.1)	3 (2.1)	23 (16.1)

Appendix 3.6: Training in School Management – Head Teachers

Training	Public, N (%)				APBET, N (%)			
	Co	T1	T2	T3	Co	T1	T2	T3
No training	3 (7.7)	6 (16.2)	3 (7.9)	4 (11.8)	5 (13.9)	6 (16.7)	4 (11.1)	6 (17.7)
University	2 (5.1)	3 (8.1)	1 (2.6)	2 (5.9)	0	0	4 (11.1)	0
KICD	25 (64.1)	27 (73.0)	29 (76.3)	26 (76.5)	27 (75.0)	18 (50.0)	19 (52.8)	20 (58.8)
Montessori	2 (5.1)	0	0	0	2 (5.6)	4 (11.1)	4 (11.1)	1 (2.9)
Kindergarten	5 (12.8)	1 (2.7)	4 (10.5)	2 (5.9)	0	3 (8.3)	1 (2.8)	0
Primary	2 (5.1)	0	1 (2.6)	0	2 (5.6)	5 (13.9)	3 (8.3)	4 (11.8)
Other	-	-	-	-	0	0	1 (2.8)	3 (8.8)

Appendix 3.7: Availability of Teaching Records

Treatment group	Public				
	Lesson plan	Learners' progress records	Schemes of work	Record of work	Health record
Co	23 (60.5)	33 (86.8)	24 (63.2)	22 (57.9)	32 (84.2)
T1	18 (48.7)	25 (67.6)	20 (54.1)	22 (59.5)	27 (73.0)
T2	20 (54.1)	26 (70.3)	20 (54.1)	23 (62.2)	24 (64.9)
T3	21 (58.3)	24 (66.7)	18 (50.0)	23 (63.9)	22 (61.1)
Total	82 (55.4)	108 (73.0)	82 (55.4)	90 (60.8)	105 (71.0)
	APBET				
Co	13 (37.1)	23 (65.7)	14 (40.0)	10 (29.4)	23 (65.7)
T1	17 (46.0)	17 (46.0)	17 (46.0)	10 (27. 8)	22 (59.5)
T2	12 (32.4)	28 (75.7)	11 (29.7)	16 (43.2)	29 (78.4)
T3	14 (41.2)	26 (76.5)	17 (50.0)	10 (29.4)	25 (73.5)
Total	56 (39.2)	94 (65.7)	59 (41.3)	46 (32.6)	99 (69.2)

Appendix 4.1: Distribution of Learner Direct Assessment items by the Main Domains

Assessment area	Items	
	Number	%
Executive function	6	6.7
Psychosocial	5	5.6
Literacy	51	57.3
Numeracy	24	27.0
Health and hygiene	3	3.4
Total	89	100.0

Appendix 4.2: Distribution of Literacy and Numeracy items by Sub-domains

a) Literacy

Literacy assessment area	Items	
	Number	%
Rhymes	7	13.7
Letter naming	20	39.2
Letter sounds	10	19.6
Initial sound discrimination	10	19.6
Listening comprehension	4	7.8
Total	51	100.0

b) Numeracy

Numeracy assessment area	Items	
	Number	%
Shape identification	3	12.5
Number naming	10	41.7
Producing sets	2	8.3
Quantity discrimination	3	12.5
Additional and subtraction using objects	2	8.3
Mental addition	1	4.2
Measurement vocabulary	3	12.5
Total	24	100.0

Appendix 4.3: Tayari School Readiness Index Across Subgroups of Interest

a) Tayari school readiness index by learner sex

Learner sex	Public			APBET		
	Mean	SE	p-value	Mean	SE	p-value
Boys	36.71	0.84		39.85	1.09	
Girls	37.19	1.00	0.7169	40.34	0.97	0.7341
Total	36.81	0.8		40.41	0.9	

b) Tayari school readiness index by teacher sex

Learner sex	Public			APBET		
	Mean	SE	p-value	Mean	SE	p-value
Male	32.51	1.40		38.90	2.95	
Female	37.05	0.86	0.22	40.43	0.92	0.8451
Total	**36.81**	**0.8**		**40.41**	**0.9**	

c) Tayari school readiness index by teacher professional qualification

Treatment group	Public			APBET		
	Mean	SE	p-value	Mean	SE	p-value
UT	31.50	1.97		42.12	1.86	
Certificate	37.55	1.13	0.02	39.90	1.25	0.32
Diploma	37.29	1.42	0.03	39.84	2.18	424
Degree	42.68	7.31	0.03	42.12	1.86	
Total	**36.81**	**0.8**		**40.41**	**0.9**	

d) Tayari school readiness index by teacher highest education level

Treatment group	Public			APBET		
	Mean	SE	p-value	Mean	SE	p-value
Primary	35.8	2.9		54.6	6.1	
Secondary	36.74	0.86	0.80	40.25	0.93	0.07
University	39.42	6.80	0.51			
Total	**36.81**	**0.8**		**40.41**	**0.9**	

Notes: *p-value < 0.1, **p-value < 0.05

Appendix 4.4: Literacy Sub-domain Scores by Treatment and ECDE type

a) Rhyme

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	37.3	1.02	42.6	1.16
T1	34.7	0.98	37.9*	1.14
T2	35.3	1.01	38.3*	1.15
T3	37.2	1.03	38.7*	1.15
Total	**36.1**	**0.51**	**39.4**	**0.58**

b) Letter naming

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	27.9	1.45	26.5	1.63
T1	34.1	1.48	22.7	1.50
T2	36.8*	1.60	21.8	1.61
T3	31.5	1.56	31.8	1.78
Total	32.6	0.76	25.7	0.82

c) Letter sounds

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	20.4	1.33	32.5	1.59
T1	14.2	1.15	30.1	1.44
T2	17.3	1.28	27.8	1.46
T3	11.8**	1.00	35.1	1.65
Total	16	0.61	31.4	0.77

d) Initial sound discrimination

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	22.7	1.42	35.9	1.72
T1	13.7**	1.11	27.4**	1.60
T2	18.8	1.34	28.0*	1.75
T3	16.7	1.23	33.6	1.66
Total	18	0.65	31.2	0.84

e) Listening comprehension

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	63.6	1.34	59.4	1.45
T1	53.1**	1.47	58.7	1.41
T2	57.1	1.60	62.1	1.50
T3	50.5**	1.61	63.0	1.45
Total	56	0.76	60.8	0.73

Notes: *p-value < 0.1, **p-value < 0.05

Appendix 4.5: Numeracy Sub-domain Scores by Treatment and ECDE Category

a) Shape identification

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	63.1	1.48	71.9	1.49
T1	60.0	1.60	70.7	1.44
T2	60.2	1.58	72.2	1.55
T3	63.2	1.58	73.4	1.50
Total	61.6	0.78	72	0.75

b) Number naming

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	27.1	1.63	51.5	1.93
T1	23.7	1.6	46.3	1.93
T2	23.8	1.62	44.9	2.02
T3	20.8	1.58	55.2	1.92
Total	24.0	0.81	49.5	0.98

c) Producing sets

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	49.0	1.77	43.5	1.87
T1	45.4	1.80	46.9	1.82
T2	49.5	1.80	43.8	1.94
T3	42.5*	1.84	47.3	1.88
Total	46.6	0.9	45.4	0.94

d) Quantity discrimination

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	58.7	1.58	64.6	1.71
T1	56.8	1.63	58.1*	1.71
T2	58.8	1.61	60.8	1.79
T3	54.2	1.68	62.8	1.69
Total	57.1	0.81	61.6	0.86

e) Addition & subtraction using objects

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	31.7	1.69	24.3	1.76
T1	33.7	1.88	28.9	1.76
T2	31.8	1.79	24.7	1.77
T3	35.1	1.90	27.8	1.85
Total	33	0.91	26.4	0.89

f) Mental addition

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	2.0	0.6	0.7	0.37
T1	3.6	0.81	3.7**	0.86
T2	3.5	0.81	2.60	0.77
T3	6.5**	1.13	1.7	0.61
Total	3.8	0.42	2.2	0.34

g) Measurement vocabulary

Treatment group	Public		APBET	
	Mean	SE	Mean	SE
Co	62.2	1.54	51.8	1.74
T1	62.1	1.58	52.7	1.72
T2	58.3	1.62	51.8	1.79
T3	58.9	1.74	51.4	1.70
Total	60.4	0.81	52	0.87

Notes: *p-value < 0.1, **p-value < 0.05

Appendix 4.6: Baseline item characteristics

Main Domain	Item	Item Code	Item Descriptor	Location	Prob.	Infit Mean Square	ICC Shape	% Correct	Point Biserial	Recommendation for next data collection wave	Subtask included in *Tayari* School Readiness Index
EXECUTIVE FUNCTION	1	a1_1	Backward digit span: 4..1	1.29	1.00	1.01	OK	14	0.41	Keep	*Subtask 1*: Executive function (6 items)
	2	a1_2	Backward digit span: 6..2	1.62	0.97	0.98	OK	12	0.42	Keep	
	3	a1_3	Backward digit span: 3..5..6	2.85	0.99	0.94	OK	5	0.34	Keep	
	4	a1_4	Backward digit span: 2..8..8	2.50	1.00	0.96	OK	6	0.35	Keep	
	5	a1_5	Backward digit span: 4..8..2..7	3.44	1.00	0.99	OK	3	0.25	Keep	
	6	a1_6	Backward digit span: 1..6..4..5	3.44	1.00	0.96	OK	3	0.27	Keep	
PSYCHO-SOCIAL	7	b1_1a	How boy/girl is feeling	-2.55	0.75	1.09	OK	82	0.28	Keep	
	8	b1_2a	What to do make him/her feel better?	-1.32	0.33	1.11	OK	60	0.35	Keep	
	9	b1_3a	Anything else you can do	-0.06	0.01	1.23	OK?	34	0.30	Review	
	10	b2_1a	What makes you feel sad?	-1.81	0.17	1.13	OK	70	0.30	Keep	
	11	b2_2a	Things that make you feel happy	-1.48	0.42	1.11	OK	64	0.34	Keep	
	12	c1_1	Rhyme: look	0.11	0.00	1.35	OK?	31	0.19	Review	*Subtask 2*: Rhyme (7 items)
	13	c1_2	Rhyme: three	0.08	0.00	1.35	OK?	31	0.20	Review	
	14	c1_3	Rhyme: joy	-0.20	0.00	1.37	OK?	37	0.19	Review	
	15	c1_4	Rhyme: wish	-0.68	0.00	1.31	OK?	47	0.23	Review	
	16	c1_5	Rhyme: baba	0.71	0.00	1.31	OK?	20	0.20	Review	
	17	c1_7	Rhyme: kaka	-0.60	0.00	1.31	OK?	45	0.23	Review	
	18	c1_8	Rhyme: kuku	-0.94	0.00	1.29	OK?	53	0.23	Review	
	19	c2_1	Letter m	-0.02	0.88	0.93	OK	32	0.53	Keep	
	20	c2_2	Letter a	0.69	0.78	0.91	OK	22	0.53	Keep	
	21	c2_3	Letter u	-1.16	0.92	1.01	OK	54	0.44	Keep	
	22	c2_4	Letter k	-0.11	0.74	0.92	OK	34	0.54	Keep	

#	Code	Item	Subtask							Decision
23	c2_5	Letter t		0.34	0.73	0.92	OK	27	0.54	Keep
24	c2_6	Letter l		0.18	0.66	0.90	OK	29	0.55	Keep
25	c2_7	Letter n		0.08	0.63	0.90	OK	31	0.55	Keep
26	c2_8	Letter o		-0.48	0.80	0.95	OK	41	0.52	Keep
27	c2_9	Letter w		0.07	0.16	0.85	OK	31	0.60	Keep
28	c2_10	Letter e		1.19	0.55	0.89	OK	17	0.53	Keep
29	c2_11	Letter i		0.37	0.24	0.86	OK	27	0.58	Keep
30	c2_12	Letter h	**Subtask 3:**	-0.08	0.34	0.88	OK	33	0.57	Keep
31	c2_13	Letter s	Letter naming	0.26	0.08	0.83	OK	28	0.61	Keep
32	c2_14	Letter b	(20 items)	0.46	0.25	0.86	OK	25	0.58	Keep
33	c2_15	Letter y		-0.32	0.08	0.84	OK	37	0.60	Keep
34	c2_16	Letter z		0.21	0.19	0.86	OK	29	0.59	Keep
35	c2_17	Letter g		0.73	0.61	0.93	OK	21	0.52	Keep
36	c2_18	Letter d		1.09	0.36	0.87	OK	18	0.55	Keep
37	c2_19	Letter j		0.39	0.08	0.84	OK	26	0.60	Keep
38	c2_20	Letter r		0.45	0.24	0.86	OK	25	0.58	Keep
39	c3_1	Sound: ii		-0.55	0.96	1.03	OK	43	0.45	Keep
40	c3_2	Sound: ha		-0.29	0.99	1.03	OK	37	0.46	Keep
41	c3_3	Sound: so		0.98	0.51	0.85	OK	19	0.56	Keep
42	c3_4	Sound: be		1.10	0.28	0.85	OK	18	0.56	Keep
43	c3_5	Sound: ya		0.91	0.57	0.87	OK	20	0.55	Keep
44	c3_6	Sound: zi	**Subtask 4:**	0.45	0.89	0.92	OK	25	0.53	Keep
45	c3_7	Sound: gu	Letter sound	0.90	0.98	0.94	OK	19	0.49	Keep
46	c3_8	Sound: da	knowledge	1.07	0.42	0.85	OK	18	0.55	Keep
47	c3_9	Sound: jo	(10 items)	1.18	0.33	0.84	OK	17	0.56	Keep
48	c3_10	Sound: re		0.94	0.47	0.85	OK	19	0.56	Keep
49	c4_1	Initial sound: "hat"		0.37	0.93	0.97	OK	27	0.50	Keep
50	c4_2	Initial sound: "man"		0.36	0.73	0.91	OK	27	0.55	Keep
51	c4_3	Initial sound: "rain"		0.27	0.59	0.91	OK	28	0.55	Keep

#	Code	Item				OK				Subtask
52	c4_4	Initial sound: "sat"	0.42	0.63	0.90	OK	26	0.55	Keep	
53	c4_5	Initial sound: "bag"	0.49	0.81	0.91	OK	25	0.54	Keep	**Subtask 5:** Initial sound knowledge (10 items)
54	c4_6	Initial sound: "tai"	0.60	0.55	0.91	OK	23	0.54	Keep	
55	c4_7	Initial sound: "nuru"	0.95	0.80	0.92	OK	19	0.51	Keep	
56	c4_8	Initial sound: "uso"	0.72	0.61	0.90	OK	22	0.54	Keep	
57	c4_9	Initial sound: "leso"	0.93	0.56	0.92	OK	19	0.53	Keep	
58	c4_10	Initial sound: "pua"	0.28	0.50	0.90	OK	28	0.56	Keep	
59	c5_1	Who stole the cat's hat?	-2.14	0.66	1.07	OK	75	0.32	Keep	
60	c5_2	What was the colour of the hat?	-0.72	0.01	1.22	OK?	48	0.30	Review	**Subtask 6:** Listening Comprehension (4 items)
61	c5_3	Why was the cat chasing the mouse?	-1.78	0.84	1.04	OK	69	0.37	Keep	
62	c5_4	Where did the cat trap the mouse?	-0.48	0.00	1.23	OK?	43	0.30	Review	
63	d1_1	Shape: Circle	-2.12	0.61	1.10	OK	75	0.30	Keep	**Subtask 7:** Shape naming (3 items)
64	d1_2	Shape: Triangle	-1.86	0.15	1.13	OK	71	0.29	Keep	
65	d1_3	Shape: Square	-1.03	0.14	1.16	OK	54	0.33	Keep	
66	d2_1	Number: 13	0.04	0.09	0.84	OK	32	0.61	Keep	
67	d2_2	Number: 11	-0.88	0.18	0.87	OK	48	0.56	Keep	
68	d2_3	Number: 14	-0.37	0.01	0.82	OK	39	0.62	Keep	
69	d2_4	Number: 12	-0.07	0.03	0.82	OK	34	0.62	Keep	
70	d2_5	Number: 18	-0.25	0.02	0.82	OK	37	0.62	Keep	
71	d2_6	Number: 17	-0.33	0.02	0.83	OK	38	0.61	Keep	
72	d2_7	Number: 15	-0.23	0.02	0.83	OK	37	0.61	Keep	
73	d2_8	Number: 19	0.30	0.39	0.91	OK	28	0.55	Keep	
74	d2_9	Number: 20	-0.46	0.01	0.81	OK	40	0.62	Keep	
75	d2_10	Number: 16	0.31	0.48	0.90	OK	28	0.56	Keep	
76	d3_1	Please give me 6 bottle tops	-0.85	0.32	1.10	OK	50	0.38	Keep	
77	d3_2	Please give me 14 bottle tops	-0.52	0.98	1.07	OK	43	0.42	Keep	
78	d4_1	Which number is bigger, 3 or 5?	-1.40	0.98	1.06	OK	61	0.39	Keep	

NUMERACY

#	Item	Description	Measure	Prob.	Infit	OK	Count	Point biserial	Decision	Subtask
79	d4_2	Which number is bigger, 8 or 6?	-1.86	0.56	0.90	OK	67	0.48	Keep	**Subtask 8:** Quantity discrimination (3 items)
80	d4_3	Which number is smaller, 4 or 7?	-0.93	0.46	0.89	OK	50	0.55	Keep	
81	d5_1a	Addition using objects: 3 add 4	0.22	0.92	1.09	OK	29	0.41	Keep	**Subtask 9:** Addition and Subtraction (3 items)
82	d5_2a	Subtraction using objects: 8 minus 5	0.10	0.77	1.12	OK	31	0.38	Keep	
83	d6_1	Mental addition: 2 plus 3	3.08	0.91	1.13	OK	3	0.15	Keep	
84	d7_1	Orders a picture of dogs from big to small	-2.21	0.08	1.11	OK	77	0.27	Keep	**Subtask 10:** Measurement vocabulary (3 items)
85	d7_2	Orders a picture of chicken from big to small	-0.79	0.10	1.17	OK	49	0.34	Keep	
86	d7_3	Orders a picture of cars from small to large	-0.53	0.03	1.20	OK	43	0.32	Keep	
87	d8_1	Wash hands before what activities	-2.49	0.65	1.06	OK	81	0.28	Keep	HEALTH AND HYGIENE
88	d8_2	Wash hands after what activities	-1.64	0.09	1.15	OK	67	0.30	Keep	
89	d9_1	Show me healthy food …	-0.92	0.00	1.36	OK?	53	0.17	Review	

	Desirable values
Probability (Prob.)	>0.05
Infit Mean Square (INMS)	0.77 to 1.19
Point biserial	0.15 to 0.80

Summary

KEEP item as it is in next wave = 79

Review item in next wave = 11

Reliability Estimate = 0.954 (Excellent)
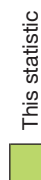
This statistic is out of the desired range
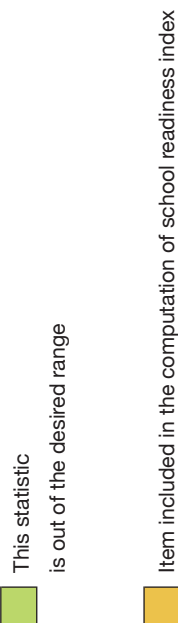
Item included in the computation of school readiness index

Notes:

Steps in the computation of *Tayari* School Readiness Index

1. Items in the learner direct assessment test were group into 10 subtasks as shown in the table above.
2. Learner percentage score on each of the 10 subtasks was computed and this was multiplied by a weighting factor of 0.1. This resulted in 10 weighted scores.
3. The 10 weighted scores from (2) above were added up, meaning that the maximum possible learner score on this *Tayari* School Readiness Index is 100%

Appendix 4.7: Histogram showing the Distribution of School Readiness Score at Student and School Level
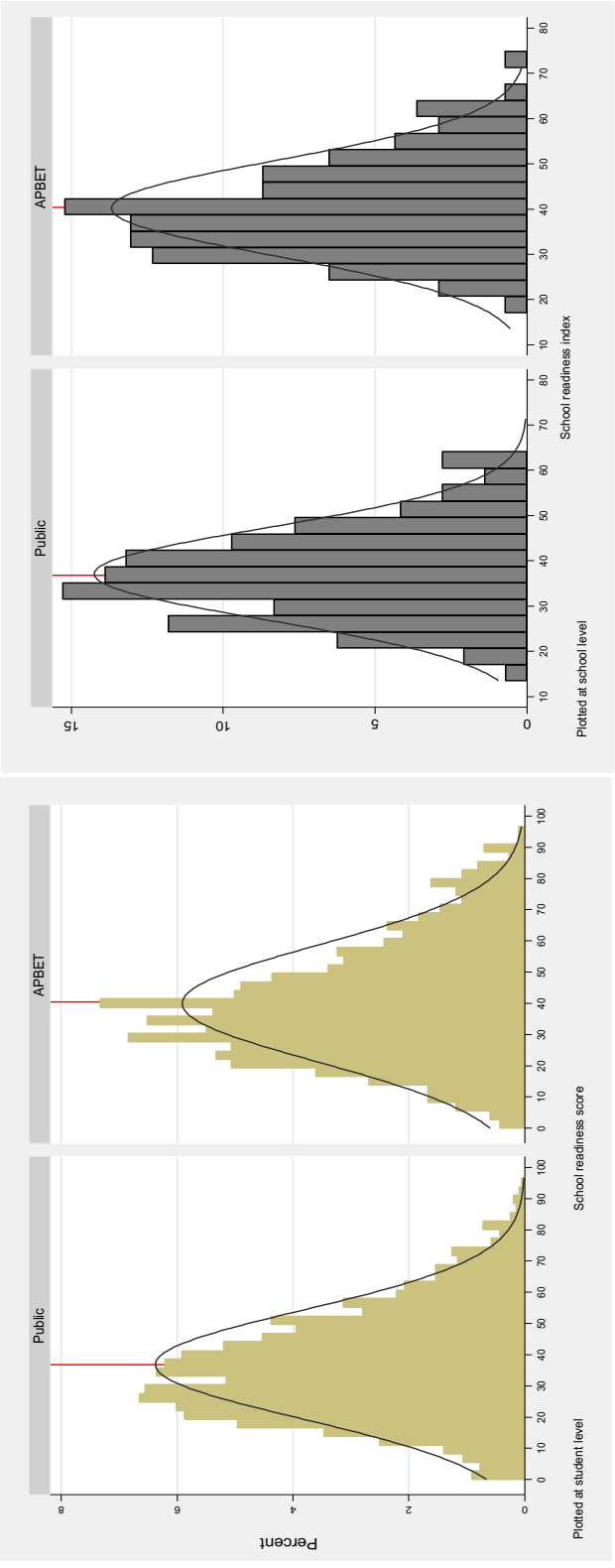
Appendix 5.1: Numeracy and Literacy Classroom Observation Items

s/no	NUMERACY	LITERACY	s/no
	A) Teacher focus		
1	Whole class	Whole class	1
2	Small Group	Small Group	2
3	One individual learner	One individual learner	3
4	Other / Not focusing on learner	Other / Not focusing on learner	4
5	Teacher not in the room	Teacher not in the room	5
	B) Instructional Content		
1	Rote Counting e.g. counting from 1-30	Letters and letter sounds	1
2	Object Counting	Phonological Awareness	2
3	Number Identification	Rhyme	3
4	Comparing sets or numbers/ Quantity Discrimination	Spelling	4
5	Addition/putting together	Grammar	5
6	Subtraction/taking apart	Reading isolated words	6
7	Money	Reading sentences	7
8	Classification e.g. matching/ordering/sorting/grouping/ sequencing/pairing/grouping	Vocabulary (word meanings)	8
9	Measurement (including daily routines/time)	Writing/dictation	9
10	Patterning	Reading texts	10
11	Other or don't know	Reading comprehension – text	11
12		Writing – creating texts	12
13		Oral read aloud	13
14		Other or don't know	14
	C) Teacher Action (Language): English (E); Swahili (S); Other-mother tongue, sheng (O)		
1	Repeating/recitation	Reading	1
2	Singing	Singing	2
3	Writing on board	Writing	3
4	Lecturing	Lecturing	4
5	Listening to learner(s)	Demonstrating	5
6	Asking question(s)	Asking questions	6
7	Monitoring learner(s)	Listening to learner(s)	7
8	Demonstrating	Monitoring learners	8
9	Playing game	Playing game	9
10	Transition	Transition	10
	D) Learner actions (Language): English (E); Swahili (S); Other-mother tongue, sheng (O)		
1	Repeating/recitation (including rote counting)	Choral reading	1
2	Listening/watching teacher	Individual reading out loud	2
3	Asking question	Silent reading	3
4	Answering question/showing answer to a question/demonstrating	Writing on paper or individual slate	4
5	Copying from blackboard/whiteboard	writing on blackboard/white board	5
6	Writing at blackboard/whiteboard	Speaking	6
7	Problem/task solving i.e. observe process of learner solving tasks given by teachers	Listening to/watching the teacher	7
8	Individual desk work	Repeating/Recitation	8
9	Group desk work	Gesturing	9
10	Singing	Singing	10
11	Other (Projects, games, etc.)	Colouring	11
12	Off task (talking, sleeping, playing)	Other (Projects, games, etc....)	12
13		Off task (talking, sleeping, playing)	13