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GEQIP-E Implementation Practices and Value-Added Learning at Primary Schools in Ethiopia

Kefyalew Endale, Mesele Araya, Tassew Woldehanna, and Ricardo Sabates

Abstract

This paper focuses on research from the RISE Ethiopia team and addresses two major objectives: analysing the progress made towards achieving key goals under the four focus areas of GEQIP-E (internal efficiency, quality, equity, and system strengthening for policy formulation and reform) and whether the indicators of GEQIP-E implementation have been associated with estimated improvements in numeracy over one academic year. The analysis is based on longitudinal data collected as part of the RISE Ethiopia programme during the academic years 2018/19 and 2021/22, as they coincide with the implementation of GEQIP-E (GEQIP-E was disrupted by the dual shocks of COVID-19 and the violent civil conflicts that erupted in November 2020). Findings are presented under the four areas of intervention (school internal efficiency, quality, equity and system strengthening) and the final section links these areas of intervention with learning outcomes.

GEQIP-E Implementation Practices and Value-Added Learning at Primary Schools in Ethiopia

Kefyalew Endale
Department of Economics and Institute of Development and Policy Research (IDPR), Addis Ababa University

Mesele Araya
Research for Equitable Access and Learning (REAL) Centre, University of Cambridge

Tassew Woldehanna
Department of Economics, Addis Ababa University

Ricardo Sabates
Research for Equitable Access and Learning (REAL) Centre, University of Cambridge

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List of acronyms

EGRA: Early Grade Reading Assessment
EMIS: Education Management Information System
ESDPV: Education Sector Development Program V
FGM/C: Female Genital Mutilation/Cutting
GEQIP: General Education Quality Improvement Program
GEQIP-E: General Education Quality Improvement Program for Equity
GPI: Gender Parity Index
IERC: Inclusive Education Resource Centre
IRT: Item Response Theory
KPI: Key Performance Indicators
NLA: National Learning Assessments
MoE: Ministry of Education
PTSA: Parent Teacher Student Association
RISE: Research on Improving Systems of Education
SIC: School Improvement Committee
SIP: School Improvement Plan

Executive summary

Ethiopia has achieved rapid growth in primary school enrolment following the implementation of the first and second phases of the General Education Quality Improvement Program (GEQIP). However, the sector's performance continues to be characterised by a lack of internal efficiency, such as: a high rate of grade repetition and dropout before completing a certain level; poor learning outcomes in reading and mathematics; large inequality by gender and location; and the absence of a strong system for planning, policy formulation and reform (World Bank, 2017; MoE, 2018). The General Education Quality Improvement Program for Equity (GEQIP-E) was adopted in 2018/19 to strengthen the achievements of GEQIP-I and II, with an emphasis on equity (World Bank, 2017; MoE, 2018).

The theory of change of GEQIP-E identifies interventions in four focus areas to improve primary education (World Bank, 2017). To improve internal efficiency, GEQIP-E: (i) supports the expansion of preschools (to improve the school readiness of children at Grade 1); (ii) provides financial incentives to schools based on their efficiency ranks; and encourages responsible school bodies to interact with parents to enroll their children in school at the appropriate age.

Regarding the quality objective, the programme supports continuous professional development to tackle the capacity constraints of teachers, and the on-time access to key learning materials at the beginning of each school year (MoE, 2018; World Bank, 2017). To reduce inequality, Girls' Clubs, gender-sensitive provisions, and disability facilities are emphasised by GEQIP-E, together with support for reducing disparities between pastoral and non-pastoral groups. Finally, GEQIP-E supports schools in the collection of timely and reliable data about education resources (through the Education Management Information System – EMIS), and learning outcomes of students through Early Grade Reading Assessments (EGRA), and National Learning Assessments (NLA, Hoddinott *et al.*, 2019). The programme also aims at enhancing the capacity to integrate and analyse the data obtained from different sources for policy formulation and reform (MoE, 2018).

This particular research from the RISE Ethiopia team has two major objectives. The first focuses on analysing the progress made towards achieving key goals under the four focus areas of GEQIP-E: internal efficiency, quality, equity, and system strengthening for policy formulation and reform. In other words, we aim to investigate the extent to which the reform has been implemented. The

second objective is to investigate whether the indicators of GEQIP-E implementation have been associated with estimated improvements in numeracy over one academic year. Therefore, we raise the following two research questions: (1) which indicators of the GEQIP-E reform have been implemented in schools, and how these have changed between 2018/19 and 2021/22?; and (2) Which of these indicators are associated with changes in numeracy (value-added) over the academic year 2021/22?

The analysis is based on longitudinal data collected as part of the RISE Ethiopia programme during the academic years 2018/19 and 2021/22, as they coincide with the implementation of GEQIP-E. However, GEQIP-E was disrupted by the dual shocks of COVID-19 and the violent civil conflicts that erupted in November 2020. RISE Ethiopia's endline survey was also interrupted for security reasons due to the escalation of the conflict during the survey. In our second round of data collection in 2021/22, we only managed to collect data from 76 schools out of the 168 original schools which had participated in the study in 2018/19. Hence, the entirety of the present analysis is based of an analysis of this sample of 76 schools.

Findings are presented under the four areas of intervention (school internal efficiency, quality, equity and system strengthening) and the final section links these areas of intervention with learning outcomes.

i. Changes in indicators related to internal efficiency

According to the GEQIP-E criteria, a higher enrolment ratio of grade 2 to grade 1 pupils and minimum dropout rate over the school year are key performance indicators (KPI) of schools' internal efficiency. The dropout rates in the 76 schools we revisited in June 2021/22 were 13.2% (Grade 1) and 9.4% (Grade 4), which had declined from about 27% in Grade 1 and 18% for Grade 4 in 2018/19. Although this might not be an accurate indicator of grade survival, it allows us to estimate the proportion of students who complete the academic year. This indicates a relative improvement in student retention over a school year, which is in line with the GEQIP-E result target.

Data on school principals shows modest improvements in the measures taken to enhance internal efficiency in early grades in RISE sample schools during the GEQIP-E period. For instance,

preschool availability expanded from 76% to 79%. Moreover, accessibility to preschool improved moderately from 5.2 km to 3.1 km. These efforts are made to enhance school readiness, which in turn helps to increase internal efficiency by improving the progression to Grade 2.

Analysis of household data also indicates an increase in preschool attendance for those students who were in Grade 1 from 60% to 66% during the GEQIP-E period. Further investigation, however, shows a large disparity between rural and urban children in terms of preschool attendance. Most of the improvements occurred in urban areas, with marginal changes in rural areas. For instance, preschool attendance in urban areas increased from 70% to 81%, while in rural areas, the figure was stagnant at about 51%. In emerging regions, which are less developed and dominated by pastoralist populations, preschool attendance declined from 54% to 48%. The majority of caregivers reported that the reason for non-enrolling their children in preschool was the lack of access, i.e. the unavailability of preschools and/or the long distances involved in reaching them.

ii. Changes in indicators related to education quality

Data from the principals' survey shows that almost all schools had a School Improvement Plan (SIP) and a School Improvement Committee (SIC) in the first year of GEQIP-E. However, the share of schools with a SIP and a SIC showed a slight decline. Moreover, schools' eligibility, actual access, and on-time access to school grants and additional school grants, declined after the pandemic. Despite the challenges, we noticed an improvement in some of the key indicators intended to enhance education quality.

Analysis of the household survey data indicates an increase in the availability of textbooks for Grade 1, from 74% to 84%. Although it is from a lower baseline, the increase is particularly higher for rural areas, where the share of Grade 1 children with access to textbooks increased by 18 percentage points, from 64% to 82%, compared to an increase of 4 percentage points, from 83% to 87% for urban Grade 1 students. Nevertheless, access to textbooks in emerging regions (Somali and Benishangul Gumuz) was limited even compared to the overall rural average. Over one-third (36%) of Grade 1 and 41% of Grade 4 students in the sample schools from the emerging regions had no access to textbooks in 2021/22.

Other quality-related indicators include school principals' awareness and knowledge of GEQIP-E reforms and professional development activities to enhance leadership skills and improve teachers' subject knowledge. Results show 70% of school principals were aware of GEQIP-E in 2018/19 which then further increased to 92% in 2021/22. About 91% of the schools were visited by supervisors and key teachers from cluster schools in 2021/22. The average number of visits stood at 2.45, which is slightly lower than the required 3 visits per academic year. On the other hand, principals' involvement in school-level professional development (including leadership) and the number of times such professional development courses were conducted, decreased. The share of teachers who performed their duty below what is considered "acceptable standards" also decreased from 17% to 15%.

iii. Changes in indicators related to equity

The equity objective of GEQIP-E included reducing education outcome disparities by gender, location, and disability status. 82% of schools had gender-sensitive school improvement programmes in 2018/19, but in 2021/22 this figure decreased to 80%. Girls' Clubs have been promoted for Grade 5-8 girls as part of an education retention effort. In 2018/19 about 96% of the schools had Girls' Clubs, but this declined to 84% in 2021/22. Girls' Clubs activities were restricted only to menstrual health management and sexual reproductive health issues in 2021/22. Access to toilet facilities was already high (94%) in 2018/19 and improved slightly to 96% in 2021/22. Out of the total number of schools, 91% had separate latrines for boys and girls in both periods. But the availability of private places to wash out menstrual cloths was extremely limited at 45% in 2018/19, and increasing only slightly to 50% in 2021/22.

Regarding students with special needs, the share of schools with dedicated school improvement programmes did not change significantly (remained around 68% to 63%). However, the overall access to inclusive education for children with disabilities improved moderately between the two academic years. For instance, the share of schools with special-needs materials such as Braille textbooks increased from 29% to 38%. Special-needs material support and facilities such as one or more ramps for wheelchairs, also improved between 2018/19 and 2021/22.

Analysis of the interventions to enhance the disparity between pastoral and non-pastoral communities, on the other hand, shows a lack of adequate efforts to meet the objectives. Data has

not been collected about students from the pastoral communities even if there is an awareness that students from these communities have been enrolled. Moreover, training for teachers on how to teach these students, access to learning and teaching materials designed to teach pastoral children, and the employment of local facilitators are quite limited. Although the overall access to school meals has increased from 3% to 25%, the increments are observed only in Addis Ababa. The share of students who received financial support and education-related materials such as uniforms and school equipment, increased from 10% to 15%. However, as in the case of indicators such as school meals, the support is largely made available for urban students even though children from rural areas are in a disadvantaged position relative to their urban counterparts.

iv. System strengthening for policy formulation and reform

The data shows that the share of schools using Education Management and Information Systems (EMIS) decreased from 83% to 76%. Moreover, a majority of schools lack access to computers and internet connections. In 2021/22, only 40% of schools had working computers for students to use. The share of internet-connected schools was also only 17% in 2018/19, which improved moderately to 28% by 2021/22. Given the decline in schools using EMIS and the limited access to functional computers and internet connections, gathering accurate information about educational resources on a timely basis could be challenging.

v. Value-added learning in relation to GEQIP-E indicators

Value-added is measured by the difference in numeracy test scores at the beginning and the end of the 2021/22 school year. The results show that in early numeracy scores of Grade 1 students, preschool enrolment (in public as well as private schools) is significantly associated with larger value-added. Principals' awareness of GEQIP-E reforms, and school-based continuous professional development activities, are significantly associated with greater value-added learning in Grades 1 and 4. Access to training or specific information about GEQIP-E is significantly associated with larger value-added learning in Grade 1, whereas school visits by supervisors and key teachers from cluster schools is significantly associated with larger value-added learning in mathematics in Grade 4. Grade 4 mathematics teachers' content knowledge is also associated with higher value-added in mathematics in Grade 4 students.

Recommendations

The findings suggest the following:

- GEQIP-E was not implemented as planned due to the dual shocks of COVID-19 and the conflict in 2020. As a result, learning losses were reported over the programme period. Greater effort and increased resources will be needed to counter the negative effects on learning outcomes, caused by these two disruptive factors.
- Though overall improvements in access to textbooks are recorded in both Grade 1 and Grade 4, there is a wide gap between emerging regions and others. Proper implementation of SIPs, and delivering grants on time to emerging schools could help improve the poor learning environment in emerging regions.
- The expansion of preschools is taking place largely in urban areas. Emphasis should be given to improving access to preschool in rural and pastoral areas.
- Regression analysis shows that rural children in both grades perform poorly compared to their urban counterparts. This is largely associated with rural students' limited access to preschools, textbooks, and school meals, among others. The findings suggest that efforts focusing on rural areas need to be strengthened, to reduce the disparities in learning outcomes between urban and rural areas.

1. Introduction

The government of Ethiopia implemented GEQIP-In three phases between 2008/9 and 2021/22, to improve students' learning outcomes and to meet the human capital needs of the country (Hoddinott, 2019; Tiruneh, Sabates, Woldehanna, 2021; World Bank, 2017). GEQIP-I (2008-2013) focused on enhancing the learning-teaching process through the increased provision of essential educational resources. GEQIP-II (2013-2018) carried forward the resource provision objective of GEQIP-I, and focused on information and technology support as an additional objective.

The learning environment improved significantly since 2008, following the implementation of GEQIP-I, GEQIP-II, and earlier reforms. Notable improvements were included the supply of qualified teachers, textbooks, and other learning materials (World Bank, 2017). The large-scale textbook production and distribution system under GEQIP helped increase the textbook-pupil ratio in primary education (Grade 1-8) from 1.5 in 2009/10 to 3.4 in 2020/21 according to the Ministry of Education. The most recent textbook-pupil ratio suggests that on average, each student received four textbooks[1] during the academic year. The share of primary school teachers with the required qualification[2] stood at 38% in 2009/10 (MoE, 2010/11), but increased to 70% in 2013/14 (55% in Grades1-4, and 92% in Grades 5-8) (MoE, 2015); and in 2019/20, it increased to over 90% (90.1% in Grades 1-4, and 97.4% in Grades 5-8). The pupil-teacher ratio in primary education was 51 in 2009/10 but this decreased to 37 (48 in Grades 1-4, and 32 in Grades 5-8) in 2019/20 (MoE, 2020). A lower pupil-teacher ratio indicates better opportunities for pupil-teacher contact and an improved teaching/learning process. The number of primary schools also expanded from 26,660 to 28,349 between 2006/07 and 2010/11 (MoE, 2010/11), and further increased to 37,039 in 2019/20 (MoE, 2020).

The changes in the learning environment have been followed by remarkable increases in pre-primary and primary education enrolment (MoE, 2020). The gross enrolment in preschool for girls and boys increased from 33% and 35% in 2013/14, to 44.1% and 46.6% in 2019/20 respectively.

[1] A huge disparity in textbook-pupil ratios remains across regions (high in Harari (6.7), Addis Ababa (5.8), and Amhara (5.5), and lowest in Somali (1.9).

[2]The national standard requires primary school teachers to have a diploma and other higher qualification from Colleges of Teachers Education.

Net enrolment in preschool was slightly lower than gross enrolment, 26.7% for girls and 28.3% for boys in 2019/20. Kindergarten[3] is the most common type of preschool in Addis Ababa and other urban centres, while O-Class is the major type of preschool in rural areas. In terms of primary education, net enrolment in Grades 1-8 increased from 83% to 95% between 2008/09 and 2019/2020. The enrolment rate of children with special needs also increased from 4% in 2013/14 to 11.1% in 2019/20. However, this is far behind the 2019/20 target of 75% (MoE, 2020).

Despite the registered growth in enrolment, primary education has been characterised by high internal inefficiency, inequality, poor learning outcomes, and the absence of a strong system for policy design and reform (MoE, 2018; World Bank, 2017). Efficiency in education refers to the ability to produce graduates of a particular education cycle or level, through the efficient utilisation of scarce resources (MoE, 2020). The common measures of efficiency in primary education are: low grade repetition and low dropout rates (especially in Grade 1), a high survival rate to Grade 5, and a completion rate for Grade 8. There is an implication that those who repeat grades, utilise more resources, and dropping out before completing a certain cycle or level is a waste of scarce resources.

Evidence of internal inefficiency in primary education is indicated by a high dropout rate and low survival rates to Grade 5. The dropout rate in Grade 1 girls and boys were 23% and 21% respectively in 2013/14, which changed only slightly in 2018/19 – 21% for girls and 22% for boys. This was still well above the target rate of 9% for girls and 8% for boys in 2018/19 (MoE, 2020). While the dropout rates for Grades 2-8 was 11% in 2013/14 for both genders, they increased to 13% for girls and 14% for boys in 2018/19, even though the target was 4% for both sexes. The survival rate to Grade 5 for girls and boys also deteriorated from 57% and 54% in 2013/14, to 53% and 50% in 2019/20 respectively (MoE, 2020). The drivers of internal inefficiency include class absenteeism as a result of poor learning environments such as large class sizes and a lack of proper monitoring (World Bank, 2017).

[3] There are three types of preschools: kindergarten (a 3 year programme for 4-6year-old children); O-class (a one-year enrolment programme for 6 year old children before starting Grade 1) and the child-to-child system, in which Grade 5 or 6 children play with their younger siblings and neighborhood children to help them identify colors and letters (MoE 2020).

The proficiency levels have also remained very low. The increased enrolment in primary education has not been accompanied by quality improvement, as most primary-level students fail to acquire reading competency. According to the MoE (2022), the share of Grade 2 and Grade 3 students unable to read increased from 40% and 24% in 2016, to 47% and 28% in 2018, and further increased to 68% and 51% in 2021 (MoE, 2022). The causes of low proficiency include poor teacher quality and a poor learning environment. The former is driven by inadequate teacher training programmes and the admission of low-quality candidates. The latter, on the other hand, arises due to delays in receiving school grants and the unavailability of key learning resources (such as textbooks) at the beginning of the school year (World Bank, 2017).

Inequity in education has been also a concern, especially for girls, students with special needs, and those from pastoralist communities. The gender disparity in primary education enrolment has decreased over time, especially in Addis Ababa, Tigray, and Amhara regions (MoE, 2020). In 2019/20, the Gender Parity Index (GPI) for Grade 1-8 students in Addis Ababa, Tigray, and Amhara in 2019/20 was 1.13, 1, and 0.98, respectively. However, in the emerging regions (Somali, Afar, and Benishangul Gumuz) boys were more advantaged than girls in terms of enrolment. The GPI for Grade 1-8 students in 2019/20 was 0.75 in Somali, 0.82 in Afar, and 0.86 in Benishangul Gumuz (MoE, 2020). The large disparity between boys and girls in these regions stems from gender norms and harmful traditional practices such as early marriage and Female Genital Mutilation/Cutting (World Bank, 2017).

Children with special needs have also been neglected due to constraints including: education resources such as braille text books; a lack of awareness; and schools' limited capacity to implement special needs education. The gross enrolment of children with special needs in primary school (Grades 1-8) in 2019/20 was only 11.1% or 323,748 students, indicating that about 2.6 million children with disabilities were not receiving primary education (MoE, 2020). Children in pastoral areas form the other neglected group in need of special attention. The high mobility of households in these areas in search of water and grazing land for their livestock during dry seasons, creates a special challenge in providing proper education for children in these communities (World Bank, 2017).

As a result, access to primary education especially for Grades 5-8 remains a challenge in Afar and Somali which have the highest proportion of the pastoralist population out of the region's total population. Nationally, net enrolment in Grades 1-4 in 2019/20 was 103.9%, but in Afar and Somali, the figures enrolment were only 54.3% and 84.6%, respectively. The net enrolment in the emerging regions has worsened, especially in Grades 5-8 (20% in Afar, 29.6% in Somali in 2019/20). This is compared with the national net enrolment rate in the Grades 5-8 of 65.8* in the same year (MoE, 2020).

The government of Ethiopia adopted GEQIP-E (2018-2022) to carry forward the achievements of GEQIP-I and II, and to overcome the issues of internal inefficiency, quality learning outcomes, equity in education, and system development in primary education (Hoddinott, 2019; World Bank, 2017; MoE, 2018). The theory of change of GEQIP-E has identified various interventions to meet the four interrelated objectives (World Bank, 2017). To improve internal efficiency, GEQIP-E supports the expansion of preschools (to improve children's school readiness at Grade 1); provides competition-based financial incentives to schools based on their efficiency ranks. and increases efforts to engage with parents to enroll their children at the appropriate age. The interventions to meet the quality objective, on the other hand, aim at tackling the capacity constraints of teachers and improving the learning environment in schools. Emphasis is given to school-based continuous teacher professional development, and on-time access to learning materials such as textbooks (MoE, 2018; World Bank, 2017).

To address the issue of equity, Girls' Clubs have been identified as a potential solution to reduce the Gender Parity Index (GPI) in upper primary education (Grades 5-8), by retaining girls in school. Moreover, life-skills training focusing on menstruation, sexual reproductive health, early marriage, FGM/C, and gender-sensitive school improvements are also emphasised to narrow the GPI. For children with special needs, improving the learning environment (including materials which aids children with disabilities), and implementation of special needs sensitive school improvements have been identified. To tackle the disparities between pastoral and non-pastoral students, school feeding, child grants for schooling or conditional cash transfers for the bottom 20% of impoverished households , and the construction of schools in pastoral communities, were highlighted (World Bank, 2017). As part of system development and improvement, GEQIP-E supports the collection of reliable data through EMIS, and on student performance through EGRA

and NLA. Another important aspect has been enhance the integration and use of these data streams for policy formulation and reform (Hoddinott *et al.,* 2019).

The two major objectives of this study are:

i. To analyse the progress made towards achieving the four focus areas of GEQIP-E (internal efficiency, quality, equity, and system strengthening for policy formulation and reform).
ii. To investigate whether the indicators of GEQIP-E implementation were associated with estimated improvements in numeracy over one academic year.

This in turn raises the following research questions: (1) which indicators of the GEQIP-E reform have been implemented in schools, and how have these changed between 2018/19 and 2021/22?; and (2) Which of these indicators are associated with changes in numeracy (value-added) over the academic year 2021/22?

2. Sampling and Analytical Strategy

2.1 Sampling Strategy

We have used longitudinal data collected by RISE Ethiopia in 2018/19 and 2021/22[4]. RISE follows a sampling design which ensures representation of different regions and reflects three features of the education reform in Ethiopia: (i) GEQIP-E is a follow-up of GEQIP-I and GEQIP-II; (ii) the rollout of some components of GEQIP-E in a phased manner; and (iii) the importance of including emerging regions where equity is a high concern (Hoddinot *et al.,* 2019).

To ensure regional representation, a total of 168 primary schools were selected in 2018/19 from Addis Ababa, Tigray, Amhara, Oromia, SNNP, Somali, and Benishangul Gumuz (Table 1). Samples from Addis Ababa represent urban areas; Benishangul Gumuz and Somali regions represent emerging regions; and the remaining four sites represent the developed regions. To ensure that we capture changes over time in the GEQIP reform GEQIP-I and II, we selected 34

[4]Details about RISE's sampling is available in Hoddinott *et al*., 2019.

schools from Young Lives'[5] sample.. To allow for geographic/spatial variations, 38 schools (Phase I schools) were selected from disadvantaged areas of each sample region. Finally, the remaining 96 sample schools (57%) were selected randomly using the list of schools provided by the Ministry of Education.

Table 1: The distribution of sample schools and students in 2018/19 and 2021/22

	2018/19				2021/22			
School type	No. of schools	%	Grade 1 students	Grade 4 students	No. of schools	%	Grade 1 students	Grade 4 students
GEQIP Phase 1	38	22.6	964	977	10	13.2	294	197
Young Lives	34	20.3	869	832	17	22.4	476	354
Other randomly selected schools	96	57.1	2,430	2,335	49	64.4	1,320	938
Total	168	100	4,263	4,144	76	100	2,090	1,498

From these sample schools, two classes were selected randomly from each grade (Grade 1 and Grade 4), from which a total of 28 students were selected randomly (14 girls and 14 boys). However, in a few of the schools, the number of students in the target grades fell below 28. In such cases, all the students in that grade were interviewed. Data on learning outcomes were collected from two student cohorts in Grade 1 and Grade 4, using direct learning assessments at the beginning and end of the academic year. Households of the sample students – who are also called index children – were also surveyed, providing data on key household and child characteristics.. School principal and school facility surveys proved to be rich sources of information about GEQIP-E implementation and the resources available in the school.

The 2021/22 survey was conducted on primary schools that had been selected in 2018/19. However, out of the 168 schools surveyed in 2018/19 only 76 schools were covered in 2021/22, due to the start of the conflict[6] during the survey (Table 1). For purposes of comparability, the analyses is based only on the 76 schools covered in both 2018/19 and 2021/22. With regard to

[5] Young Lives is a longitudinal survey of two cohorts of children born in 1994/95 (old cohort) and 2001/02 (young cohort). A total of five children-focused household surveys were conducted between 2002 and 2016. Two further rounds of school surveys on lower primary education (Grade 4 and 5) were conducted in 2012/13, and on upper primary education (Grade 7 and 8) in 2016/17. The school year 2012/13 marked the end of GEQIP-I and before the start of GEQIP-II.

[6] Tigray region was excluded because of the large-scale conflict that commenced in November 2020 (before the start of the endline survey). The conflict in Tigray region then expanded into neighboring Amhara and Afar while the survey was in progress. Simultaneously, insurgent activities increased in Oromia, Benishangul Gumuz, and other regions. Hence, for reasons of safety, a decision was made to stop the survey before completion.

student sampling, those who were in the Grade 1 sample in 2018/19 were tracked and used as the Grade 4 cohort in the 2021/22 survey. These cohorts have greater exposure to GEQIP-E, having experienced it throughout Grades 1-4, compared to the 2018/19 Grade 4 cohort, who were only exposed to it during a single academic year. Given other constant factors, the 2021/22 Grade 4 cohort students are expected to score higher on value-added learning, compared to their 2018/19 counterparts.

The Grade 1 samples in 2021/22, on the other hand, were newly selected. The new cohort of Grade 1 students in 2021/22 were more exposed to GEQIP-E, compared to those enrolled in Grade 1 in 2018/19. For instance, those who were Grade 1 in 2018/19 were less likely to benefit from the preschool component of GEQIP-E as they had already passed this stage. Moreover, the preparatory work also dominated the actual implementation of GEQIP-E in 2018/19. Thus, the full benefit from the implementation of GEQIP-E is expected to be reflected with greater value-added numeracy scores in the 2021/22 Grade 1 cohort, compared to those in the 2018/19 sample.

2.2 Analytical Strategy

This study begins with an analysis of the GEQIP-E implementation descriptively, by comparing the changes in the measures taken to address high internal inefficiency, poor quality, lack of equity, and a weak education system for policy design and reform between 2018/19 and 2021/22. The changes in the indicators of the reforms are also related to the value-added estimated for both cohorts of grades 1 and 4 students.

Grade 1 numeracy test was adapted from the Measuring Early Learning Quality and Outcomes (MELQO) direct assessment tests. The MELQO test is designed to promote feasible, accurate, and useful measurement of pupils' development and learning at the start of primary school (for detailed information about the MELQO test, see UNESCO, UNICEF, Brookings Institution & World Bank, 2017). For the RISE Ethiopia project, the MELQO test was piloted with a total of 1,144 students (571 in O-class, 573 in Grade 1) in 2018 across six regions (Amhara, Benishangul-Gumuz, Oromia, SNNPR, Somali and Tigray). Based on an item-level analysis, seven out of eight direct assessment numeracy exercises were selected for use for Grade 1 pupils for the RISE Ethiopia

project in the academic year 2018-19. The same MELQO test was administered for Grade 1 pupils during the academic year 2021-22 survey.

The Grade 4 numeracy test for RISE Ethiopia was adapted from the Grade 4 maths test from the Young Lives Ethiopia School Survey conducted in 2012-2013 (James, 2014). The test for numeracy was revised and updated in February 2018, following guidance by test developers from the Ministry of Education and the National Educational Assessment and Examinations Agency (NEAEA). The final test included 25 items which were administered at the beginning of the 2018-19 academic year and modifications done for the end of the academic year. The exact same test was also administered for Grade 4 pupils during the 2021-22 academic year. Item response theory was used as methodology to estimate changes over time (Araya, *et al.*, 2023).

For this, we use regression analysis to estimate if the indicators of GEQIP-E were associated with value-added in numeracy during the academic year 2021/22. More formally, define ΔY_{iHS} as the value-added learning outcomes (measured by the difference between the scores at the beginning and end of the 2021/22 school year) for child i living in household H, attending school S.

$$\Delta Y_{iHS} = \beta_0 + \beta_1 Score\_Year\_Begining_{iHS} + \gamma GEQIP - E + \delta H + \varphi CH + \varepsilon_{iHS} \qquad (1)$$

$Score\_Year\_Begining_{iHS}$ is the score at the start of the 2021/22 academic year for child i living in household H in school S. $GEQIP - E$ is a vector of GEQIP-E indicators, such as: school principals' awareness and access to GEQIP-E related training or information; visits by supervisors and key teachers from cluster schools; frequency of school-based professional development programmes, existence of a preschool; and GEQIP-E indexes (information index, training index, O-Class index, gender equity index, and special needs friendly school environment index), computed from related subcomponents of the reform. Vector CH denotes child-specific characteristics such as age and gender, and Vector H denotes a host of household characteristics such as household size, wealth status, and location of the residence. Finally, ε_{iHS} is the error term. Simple regression methods are employed to estimate the value-added in numeracy scores (for Grade 1) and value-added in IRT (for Grade 4).

2.3 Limitations of the study

The analysis has a number of limitations, a few of which are highlighted here. The endline survey in 2021/22 was interrupted for security reasons, due to an escalation of conflict while the survey was in progress. Out of the 168 schools, only 76 schools were covered by the survey before it had to be curtailed. The analysis conducted is based on the subsample of schools covered in both 2018/19 and 2021/22, and there is a huge attrition bias as less than 50% of the initial sample is used for the analysis. Moreover, the outbreaks of COVID-19 and the conflict in the country in 2020 resulted in learning losses in several ways, such as due to the interruption of schooling and closures, the destruction of schools and learning facilities, and automatic promotion to the next grade when schools eventually reopened. It is likely that many of these factors are behind some of the estimations obtained for the association of GEQIP-E indicators with value-added in numeracy. The value-added learning analysis is based on a cross-sectional analysis using the 2021/22 data. Yet, the findings presented here relate some of the indicators of the GEQIP-E reform to gains in value-added in numeracy in Grade 1 and Grade 4 in the 76 schools over the academic year 2021/22. While there were challenges with the implementation of GEQIP-E, we expect to estimate hypotheses about the association of the implementation of some aspects of this reform in schools and value-added in numeracy in Grades 1 and 4. Thus, the findings should be interpreted as an association, and not causal impacts. The findings and subsequent policy implications should be interpreted with these limitations in mind.

3. Descriptive Results

This section begins with providing evidence on the changes in the measures taken to improve internal efficiency, education quality, and equity in education under GEQIP-E. Investigations are then undertaken to analyse whether the learning outcomes of Grade 1 and Grade 4 students were associated with these indicators of GEQIP-E implementation. We use data from the direct learning assessment tests, principal surveys, household surveys, and school facility observation surveys.

3.1 Changes in indicators related to internal efficiency, education quality, and equity

3.1.1 Changes in indicators related to internal efficiency

The dropout rates in the 76 schools we revisited in June 2021/22 were 13.2% (Grade 1) and 9.4% (Grade 4), which had declined from about 27% in Grade 1 and 18% for Grade 4 in 2018/19. A reductions in dropout rates is one of the indicators of internal efficiency. In addition, Table 2 presents changes in indicators related to other aspects of internal efficiency during GEQIP-E, which we gathered using data from the school principal and household surveys. O-Class is considered to be a key instrument to increase both student attendance and school readiness, which, in turn, improve internal efficiency by reducing grade repetition and dropout rates, especially in Grade 1 (Hoddinott *et al,* 2019). Data from the school principal surveys show increases in the number of recruited preschool teachers. Preschool teachers' access to in-service training, supervision, and coaching also improved, but the changes are not statistically significant.

The share of schools with preschools increased slightly from 76% to 79%. On average, more than one preschool teacher received O-class training in 2018/19 and 2021/22. During 2021/22, teachers in 63% of preschool had received in-service training, supervision and coaching within the preceding three years as part of the GEQIP-E reforms. On average, there were nearly 2 classes of preschools per school. Access to the nearest preschool centre from schools without one also improved from 5.2 km to 3.1 km. The improvement could be greater, because in eight of the sample schools without a preschool in 2018/19, the distance was not reported because the principals did not know of any nearby preschool facilities near their school.

The other instrument used to drive internal efficiency includes school ratings based on independent inspection. The inspection is intended to ensure the minimum standard of schools and outcome of students (Beline, 2021). Schools are rated into four levels (Level 1-4) based on based 26 standards of which 25% are input[7] standards, 35% are processes standards, and 40% are outcome standards (Beline, 2021; World Bank, 2017). Schools rated as Level 3 and Level 4 are considered to have met the national standard. The share of rated schools declined from 98% to 83%, but among these, the share of schools meeting the national standard (Level 3&4) increased from 35% to 45%

[7] "Inputs include school facilities, building, human and financial resources; Process: the school vision, mission, values and plans; learning and teaching; curriculum, assessment; monitoring and evaluation; a partnership of the school, parent and community and Outcome: the school and students outcomes, teachers and education leaders personal development and participation of parents and the local community." (Belina, 2021).

(although the number of schools with inspections is slightly lower in 2021/22 than in 2018/19).

Community meetings and PTSA are important components of the education reform to improve internal efficiency. The data from the principals' survey shows the share of schools with a PTSA decreased significantly from 97% to 90%, and the share of schools which reported three or more PTSA meetings also decreased. Producing and displaying school report cards in a public area within the school is required to show the school's performance on key performance indicators, including on-time enrolment, low dropout rates, and grade progression. The percentage of schools which displayed the report card increased only marginally, from 46% to 51%.

Table 2: Changes in indicators related to internal efficiency between 2018/19 and 2021/22

Variable	2018/19			2021/22		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
O-Class is provided at the school (%)	76	76	43	76	79	41
Of the schools with preschool						
No. of O-class teachers recruited from within the school	58	0.8	1.6	60	1.1	1.4
No. of O-class teachers recruited from outside the school	58	1.43	1.31	60	1.48	1.42
No. of teachers who received O-class training	58	1.36	2.21	60	1.58	1.32
% of O-class teachers who received the revised in-service training, supervision & coaching in the preceding 3 years as part of GEQIP-E's reforms				60	63	49
No. of O-Class sections in the academic year				60	1.75	0.97
Distance from the nearest O-class facility in km ***(among schools with no-preschool)***	10	5.2	8.9	16	3.13	2.45
% of schools with the latest independent-inspection rating	76	97	16	76	83	38
School's latest independent-inspection rating						
Level 1(%)	74	7	25	63	11	32
Level 2 (%)	74	58	50	63	44	50
Level 3 (%)	74	31	47	63	40	49
Level 4 (%)	74	4	20	63	5	21
% of schools with a Parent Teacher Student Association (PTSA)	**76**	**97***	**16**	**76**	**90**	**31**
Frequency of PTSA Meetings						
Did not meet due to COVID-19 (%)	74	1	12	68	4	21
1-2 times in the year (%)	74	11***	31	68	29	46
3-4 times in the year (%)	74	19	39	68	21	41
5 or more times in the year (%)	74	69***	47	68	46	50
There is a recent School Report Card displayed in a public place	76	0.46	0.50	76	0.51	0.50
Grade 1 students who dropped out in schools surveyed longitudinally (%)	1,967	27.2	44	2,090	13.2	33
Grade 4 students who dropped out in schools surveyed longitudinally (%)	1,935	18	38	1,489	9.4	29

Source: RISE survey (2018/19 and 2021/22). Note: ***, **, & * denotes 1%, 5%, and 10% statistically significant mean differences between 2018/19 and 2021/22 rounds

Results obtained from the household surveys about preschools is consistent with that obtained

from the principals' survey (Table 3). Preschool enrolment rates among Grade 1 children increased from 61% to 66% between 2018/19 and 2021/22, and the difference is significant at 1%. The increase is associated with the preschool component of GEQIP-E. The 2018/19 Grade 1 cohorts were already in Grade 1 when GEQIP-E was introduced. The increasing share of preschool enrolled children is expected to improve efficiency in first cycle primary education by raising the progression from Grade 1 to Grade 2.

The household survey data enables us to analyse equity-related changes during the programme period such as between boys and girls, rural and urban, and between students from emerging and non-emerging regions. But most of the change in Grade 1 students' access to preschool was registered in urban areas (from 70% to 81%, $p<0.01$), while in rural areas enrolment stagnated at 51% in both years. In the emerging regions (both rural and urban), enrolment remained around 54% to 48% (difference not statistically significant).

Table 3: Interval efficiency-related changes from the household surveys (2018/19 - 2021/22)

Variable	2018/19			2021/22		
	Obs	Mean	Std. Dev	Obs	Mean	Std. Dev.
Data from household surveys (Grade 1)						
Preschool enrolment (%)	1983	61***	49	2046	66	48
% of preschool enrolled girls	985	60***	49	1023	66	47
% of preschool enrolled boys	998	61*	49	1023	65	48
% of preschool enrolled in urban areas	966	70***	46	994	81	39
% of preschool enrolled in rural areas	1017	51	50	1052	51	50
% of preschool enrolled in emerging regions	314	54	50	357	48	50
Type of preschool						
Private (%)	1207	11**	32	1343	9	28
Government (%)	1207	79***	41	1343	89	31
Community [Religious/NGO /Charity] (%)	1207	10***	30	1343	2	13
Reasons for non-enrolment in preschool						
Preschool not available (%)	803	37***	48	692	28	45
Preschool too far (%)	803	27***	45	692	19	39
Parents not interested (%)	803	11	31	692	13	34
Child not interested (%)	803	10***	30	692	17	37
Other reasons (%)	803	15***	36	692	24	43
Someone in the household is related to a member of the Parent Teacher Student Association (%)	1982	5**	22	2048	7	25
The caregiver has seen the school report card posted in a public place (%)	1917	4***	20	1995	7	26

Data from the household Survey (Grade 4)[8]						
Someone in the household is related to a member of the Parent Teacher Student Association *(%)*	1902	6	24	1480	6	24
The caregiver has seen the school report card posted in a public place *(%)*	1823	4***	19	1415	16	36

Source: RISE surveys in 2018/19 and 2021/22. Note: ***, **, & * denotes 1%, 5%, and 10% statistically significant mean differences between the rounds. There are variations in the number of observations between the two rounds. The discrepancy in Grade 1 arises because in some schools, the actual number of students is lower than the intended sample size of 28 students per target grade. In addition to lower class sizes, attrition is another factor for the discrepancy in the number of observations in Grade 4 between 2018/19 and 2021/22. There were a total of 1,911 Grade 1 sample students from the 76 schools in 2018/19, but when attempting to track them in Grade 4 in 2021/22, only 1,506 of them were found.

Most of the children enrolled in preschools attended public schools (79% in 2018/19, 89% in 2021/22, $p<0.01$), followed by enrolment those enrolled in private schools (11% in 2018/19, 9% in 2021/22, $p<0.01$), and in community/religious schools (10% in 2018/19, 2% in 2021/22, $p<0.01$). The rise in preschool enrolment during GEQIP-E was largely attributed to the expansion of government funded preschools. With regard to constraints, caregivers highlighted the unavailability of preschools in their local schools (37% in 2018/19, 28% in 2021/22), and long distances from preschools in other locations (27% in 2018/19 and 19% in 2021/22) in both periods. However, the relative importance of access as a constraint has decreased over the two survey years, mainly due to the expansion of public preschools; however, the importance of a lack of student interest significantly increased from 10% to 17% ($p<0.01$), and so also 'other' reasons (which increased from 15% to 25%, $p<0.01$). These findings suggest the need to raise children's awareness of the importance of preschools, as access to the service expands. Finally, even if over 50% of the schools displayed the school report card in public places in 2021/22, only 7% and 16% of the caregivers of Grade 1 and Grade 4 students had seen it.

3.1.2 Changes in indicators related to education quality

Table 4 shows the changes in GEQIP-E indicators related to education quality as obtained from the school principal, school facility, and household surveys. Focus has been given to the main programme-related drivers such as a SIP, access to programme-related training and information, visits by principals and key teachers from cluster schools, and school-based professional

[8] The Grade 4 cohorts were Grade 1 in 2018/19. Hence, none of the Grade 4 cohorts benefited from the preschool component of GEQIP-E.

development. Most of the indicators showed modest improvements during the programme period. There were also declines in some of the outputs such as access to programme-related training or specific information, and participation in professional development.

The Ministry of Education introduced an school improvement programme including plans and committees in 1999 at the national level to improve the education outcomes of primary and secondary school students (MoE, 2010). Almost all of the schools had SIC and SIP at the start of the 2018/19 year, but at the endline, the share of schools with a SIP and a SIC significantly decreased to 88% and 93%, respectively. The share of Grade 1 caregivers who were informed about SIC meetings also decreased from 30% to 13%. However, among caregivers of Grade 1 children, the level of satisfaction with the quality of school – as measured by the average score in the scale 1 (very dissatisfied) to 5 (very satisfied), remained almost unchanged. Consistent information about school quality was obtained from the caregivers of the Grade 4 cohorts.

Timely access to school grants is a key component of education quality, to equip the schools with the necessary learning materials at the start of the school year. Eligibility to school grant was about 90% in both survey years, whereas actual access to these grants declined slightly, from 90% to 87%. Eligibility and actual access to these additional grants and small institutional top-ups decreased about by half. The percentage of schools eligible for this funding declined significantly from 36% to 15% ($p<0.01$), and the actual access declined from 26% to 15% ($p<0.1$). Eligibility and actual access to institutional top-ups also declined. Moreover, the delays associated with the receipt of the grants increased between the survey periods. For instance, the share of schools which received grants on time decreased from 53% to 50%. Given the decrease in the share of grant recipient schools and the increasing delays in receiving them, improving the learning environment in schools will be difficult.

Table 4: School Improvement Programme, grants, and access to textbooks

Variable	2018/19			2021/22		
	Obs	Mean	Std. Dev	Obs	Mean	Std. Dev
Data from principal surveys						
Schools with a School Improvement Committee (%)	76	99*	12	76	93	25
Schools with a School Improvement Plan (%)	76	99***	12	76	88	33

The performance of the SIC was reviewed (%)	75	77	42	71	85	36
The school budget is displayed in a public place (%)	76	67	47	76	57	50
There is a recent SIP displayed in a public place (%)	76	58	50	76	57	50
Grants to enhance education quality						
Schools eligible for school grants (%)	76	90	33	76	91	29
Schools eligible for additional school grants (%)	76	36***	48	76	15	35
Schools eligible for institutional top ups (%)	76	17	38	76	9	29
Schools receiving school grants (%)	76	90	29	76	87	34
Schools receiving additional school grants (%)	76	26*	44	76	15	35
Schools receiving small institution top-ups (%)	76	11	31	76	9	29
School grants received on time (%)	68	53	50	66	42	50
Additional school grants received on time (%)	19	74	45	10	70	48
Small institutional top ups received on time (%)	8	75	46	7	43	54
Data from household surveys						
Grade 1 children's household surveys						
A member of the household is an active member of a school committee at the school (%)	1982	5	23	2051	6	24
A school committee meeting has taken place at the school during the academic year (%)	1891	30***	46	1980	13	34
The caregiver attended this meeting (%)	566	78**	41	262	85	36
The caregiver has seen the school budget posted in a public place in the school (%)	1921	5***	21	2003	8	26
The caregiver has seen the School Improvement Plan posted in the school (%)	1920	6*	23	2005	7	26
Caregiver satisfied with the quality of education offered by the index child's school (on a scale of 1-5)	1910	3.16*	0.7	1997	3.2	0.8
Received textbooks (%)	**1977**	74***	44	2047	84	177
% of urban children with textbooks (%)	966	83	37	997	87	251
% of rural children with textbooks (%)	1011	64***	48	1050	82	39
% of children in emerging regions with textbooks (%)	314	50***	50	359	64	48
Grade 4 children's household surveys						
A member of the household is an active member of a school committee at the school (%)	1903	6	23	1481	6	24
A school committee meeting has taken place at the school this academic year (%)	1822	32***	47	1412	14	35
The caregiver attended this meeting (%)	592	81	40	203	76	43
The caregiver has seen the school budget posted in a public place in the school (%)	1827	5**	22	1404	7	25
The caregiver has seen the School Improvement Plan posted in the school (%)	1822	5***	23	1402	9	28
The caregiver is satisfied with the quality of education offered by the school (on a scale of 1-5)	1858	3.1**	0.7	1481	3.2	0.8
Received textbook	**1901**	89	31	1481	84	37
% of urban students with textbooks	895	92***	27	704	85	35
% of rural students with textbooks	1006	86**	34	777	83	37
% of students in emerging regions (rural and urban) with textbooks	268	66*	47	270	58	49

Source: RISE School principal, school facility, and household surveys (2018/19 and 2021/22).
Note: ***, **, & * denotes 1%, 5%, and 10% statistically significant mean differences between the 2018/19

and 2021/22 rounds.

Despite the decreases in the implementation of SIPs and decreases in the access and on-time delivery of grants, access to textbooks seems to have improved for Grade 1 children in rural schools, not for Grade 4 students (Table 4). Information from the household data shows that Grade 1 students' access to textbook increased by 10 percentage points (from 74% to 84%, $p<0.01$). This increment was predominantly accounted for by the increased access to textbooks for Grade 1 rural students (64% to 82%, $p<0.01$). Access to textbooks in Grade 4 was fairly high, with over 83% in both periods but slight decreases were recorded over the years. The disparity in access to textbooks between rural and urban Grade 4 students was low in both years compared to that in Grade 1. Further disaggregation of the data shows that Grade 1 and Grade 4 students from emerging regions (both rural and urban) were at a disadvantage compared to the overall, as well as the rural average. Moreover, the gaps in access to textbooks between emerging and the other regions increased during GEQIP-E.

Table 5 shows the changes in additional education-quality focused interventions under GEQIP-E. These include principals' awareness of the programme, principals' access to specific information about GEQIP-E or training, and awareness of the required number of visits by supervisors and key teachers from cluster schools. The proportion of school principals with some awareness of GEQIP-E increased from 68% to 92%. However, the proportion of principals who received information or training related to GEQIP-E remained relatively stable, at around 57% to 53%. GEQIP-E also requires a total of three visits by supervisors and key teachers from cluster schools but only 65% of the school principals were aware of this requirement.

GEQIP-E-related training to induce education quality includes visits by supervisors and key teachers from cluster schools, professional development activities, and teachers' participation in such activities. A majority (91%) of the schools were visited by supervisors and key teachers from the cluster schools in 2021/22. On average each of these schools was visited 2.5 times, which was lower than the required 3 visits. The share of schools which carried out professional development activities (including leadership activities) decreased from 63% to 57%.

School-based professional teachers' training in mathematics and mother-tongue subjects are also considered part of GEQIP-E to enhance educational quality. The training is offered by supervisors

and key teachers from cluster schools. The principals' survey in 2021/22 shows that school-based teacher training development was undertaken in 67% of the schools as part of GEQIP-E, in the preceding three years. But, according to the principals' evaluation, the share of teachers whose activities fall decreased only by 3 percentage points (from 17.8% to 15%). Grade 4 mathematics teachers' performance on the mathematics test also decreased, despite the school-based capacity building activities to improve teachers' subject matter knowledge.

Table 5: Education quality related interventions under GEQIP-E

Variable	2018/19			2021/22		
	Obs	Mean	Std. Dev	Obs	Mean	Std. Dev
GEQIP-E information						
% of principals aware of GEQIP-E	76	68.4***	46.8	76	92.1	27.1
% who had received information or training in relation to GEQIP-E	76	56.6	49.9	76	52.6	50.3
% of principals who were aware that the school should be visited by supervisors 3 times per academic year				76	64.5	48.2
GEQIP-E training						
% Visited by supervisors & key teachers from cluster schools				76	90.8	29.1
Number of visits by supervisors and key teachers				69	2.5	0.7
% Professional development training (eg. leadership) in the last academic year	76	63.2	48.6	76	56.6	49.9
Frequency of professional development activities						
% once in the academic year	48	41.7	49.8	43	58.1	49.9
% twice in the academic year	48	35.4	48.3	43	39.5	49.5
% three or more times in the academic year	48	22.9***	42.5	43	2.3	15.2
%Teachers' participation in school-based professional development in the past 3 years				76	67.1	47.3
Teacher information						
% who performed below acceptable levels	76	17.8	25.1	76	15	19.6
% who performed at acceptable levels	76	58.1	31.3	76	57.9	32.2
% who performed at exceptional levels	76	24.1	24.7	76	27	27.6
Grade 4 maths teachers' test score	73	61.0	15	74	59	18.9
School resources/facilities						
The school has connected & working internet access	76	17.1	37.9	76	27.6	45.0
Availability of working computers for students	76	27.6	45.0	76	39.5	49.2
Number of working computers used by students (max 40)	76	2.3	5.2	76	2.6	6.1
There is a functional library – a collection of books (not textbooks) to which children can refer (=1)	76	84.2	36.7	76	78.9	41.0
There is a functional pedagogical centre (a room where teaching and learning materials are kept) (=1)	76	84.2***	36.7	76	65.8	47.8
The school has a sports or play area (=1)	76	93.4	25.0	76	92.1	27.1

There is a staff lounge (=1)	76	34.2	47.8	76	40.8	49.5
Availability of water in the school						
No water supply at all (%)	76	34.2	47.8	76	30.3	46.2
Pipe water supply (%)	76	51.3	50.3	76	59.2	49.5
Other source of water such as tanker/bore well (%)	76	14.5	35.4	76	10.5	30.9
Water from the source is available during the day of the survey	50	76.0	43.1	53	79.2	40.9
There was electricity in the school on the day of the visit	76	55.3	50.1	76	63.2	48.6
There is normally an electricity supply in the school	76	57.9	49.7	76	65.8	47.8

Source: RISE School principal, school facility, and household surveys (2018/19 and 2021/22). Note: ***, **, & * denotes 1%, 5%, and 10% statistically significant mean differences between 2018/19 and 2021/22 rounds.

Another important factor for enhancing education quality is the access to functional school facilities. While the information from the school principal shows that there are more schools with access to computers, internet, drinking water, teacher's lounge, and electricity, the differences over the academic years are not statistically significant. It is only the proportion of schools with access to pedagogic centres which declined during the academic years, from 84% to 66%.

3.1.3 Change in the indicators related to equity in education

Table 6 shows changes in the equity-related interventions, particularly those with a focus on girls, children with disabilities, and pastoral children. Gender-related interventions include provisions of gender-friendly SIPs, Girls' Clubs, and life-skills training activities. A majority (82%) of the schools had a gender-friendly SIP in 2018/19 which declined to 80% in 2021/22. Girls' Clubs are intended to create safe spaces for girls in Grade 5-8 and induce them to continue their education. The clubs can also play a role in tackling violence against girls (Hoddinott *et al.*, 2019).

The share of schools with Girls' Clubs declined from 96% to 84% ($p<0.01$). Moreover, significant declines were also observed in activities such as sexual and reproductive health (from 87% to 71%, $p<0.05$), and life-skills training (from 75% to 49%, $p<0.01$). Other gender-friendly facilities include a separate toilet for boys and girls, and private places for girls to change and wash menstrual rags. Access to toilet facilities increased from 94% to 96%, and 91% of schools had separate latrines for boys and girls in both survey periods. But the availability of private menstrual hygiene spaces remains limited, with only a slight increase from 45% of schools in 2018/19, to 50% in 2021/22.

With regard to special needs education, SIPs have become more disability friendly over the years. In 2021/22, only 51% of the schools had access to Inclusive Education Resource Centres (IERC), indicating that much effort is needed to address the issue of limited access to education for children with disabilities and those from pastoral communities. A moderate improvement was noted in the access to educational materials for children with disabilities (from 29% to 38%). The share of schools who maintain a record of students with disabilities showed a marginal increase, from 60% to 62%. The proportion of schools which provide special needs friendly materials also increased. Among the schools which provide learning and teaching materials for children with disabilities, those that provide materials for children with visual impairments increased from 28% to 53% ($p<0.05$). We also noticed that the percentage of schools with one or more ramps for wheelchairs increased from 25% to 34%. However, access to staff training on how to teach children with disabilities, decreased from 43% to 36%.

With regard to pastoral-related activities, the share of schools with one or more students from pastoral communities increased from 56% to 63%. However, the share of schools which gather information about children from pastoral communities rose from 1% in 2018/19 to only 4% in 2021/22. There is, however, some modest progress in: access to training for teachers, on how to teach pastoral children (5% to 18%, $p<0.01$), access to teaching material designed for such children, and the employment of a facilitator from the local community to support their education.

Table 6: Changes in indicators related to educational equity

Variable	2018/19			2021/22		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
A School Improvement Plan which includes provisions for a gender-friendly school environment (%)	76	82.9	37.9	76	80.3	40.1
The school has a Girls' club (GC) (%)	76	96.1**	19.6	76	84.2	36.7
The Girls' Club provides sanitary pads (%)	76	67.1	47.3	76	73.7	44.3
The Girls' Club provide sexual and reproductive health teaching (%)	76	86.8**	34.0	76	71.1	45.7
The Girls' Club provides life-skills training (%)	76	75.0***	43.6	76	48.7	50.3
The school has toilet facilities (%)	76	94.7	22.5	76	96.1	19.6
There are separate latrines for girls and boys (%)	76	90.8	29.1	76	90.8	29.1
There is a private space away from boys where girls can wash out menstrual rags from boys (%)	76	44.7	50.1	76	50.0	50.3
Special needs friendly interventions						

The School Improvement Plan includes provisions for a disability-friendly school environment (%)	76	68.4	46.8	76	63.2	48.6
Access to IERCs (=1)				76	51.3	50.3
Distance to an IERC in km (for schools without one)				38	247.4	338.3
The school collects information of enrolled students with disabilities (=1)	76	59.2	49.5	76	61.8	48.9
Staffs receives training on educating students with disabilities (=1)	76	43.4	49.9	76	35.5	48.2
The school receives reference materials on the provision of education for students with disabilities (=1)	76	28.9	45.7	76	38.2	48.9
The school provides teaching & learning materials which are specifically designed for children with disabilities (=1)	76	35.5	48.2	76	38.2	48.9
The availability of material for children with visual impairments (=1)	29	27.6**	45.5	30	53.3	50.7
The availability of sign language dictionaries (=1)	29	44.8	50.6	30	53.3	50.7
Access to tools which help with visual and hearing impairments (=1)	29	24.1	43.5	30	33.3	47.9
The school has one or more ramps for wheelchairs	76	25.0	43.6	76	34.2	47.8
Pastoral friendly interventions						
School collects information on pastoral communities						
Yes (=1)	76	1.3	11.5	76	5.3	22.5
No (=1)	76	55.3	50.1	76	59.2	49.5
There are no pastoral communities (=1)	76	43.4	49.9	76	35.5	48.2
Teachers receive training on how to teach pastoral children (=1)	43	4.7**	21.3	49	18.4	39.1
The school provides teaching and learning materials which are specifically designed for children from pastoral areas (=1)	43	4.7	21.3	49	10.2	30.6
The school employs a facilitator from the local community to support children from pastoral areas (=1)	43	2.3	15.2	49	10.2	30.6

Source: RISE school principal and school facility surveys (2018/19 and 2021/22). Note: ***, **, & * denotes 1%, 5%, and 10% statistically significant mean differences between 2018/19 and 2021/22 rounds

Table 7 shows equity-related indicators collected from the household surveys. These include school meals and other support, such as the provision of school uniforms. Access to school meals was very limited in 2018/19 in both Grade 1 and Grade 4. A 21 percentage point increment (from 3% to 25%, $p<0.01$) for access to school meals was recorded between 2018/19 and 2021/22 in both grades. Disaggregation of the change by location, however, reveals that it was observed in urban areas, especially in Addis Ababa. In rural and pastoral areas, where school meals are most needed, this access is almost non-existent. The information on access to school meals for Grade 4

students is very similar to that seen for their Grade 1 counterparts.

In terms of access to financial/material support (other than food), about 10% of the students (9% of Grade 1 and 11% of Grade 4) received support in 2018/19. The proportion of supported students increased to 15% for grade 1 and 16% for grade 4 in 2021/22 (significant at 1%). Disaggregation of this support by residential location shows that a majority of the beneficiaries are urban students, and there is a need to improve rural students' access. The main type of financial/material support is in the form of school uniforms and materials in both grades and survey years. However, changes have been observed in the source of the support. About 60% of beneficiaries in 2018/19 received support from NGOs/charities but in 2021/22 over 90% received this from government sources.

Table 7: Changes in indicators related to educational equity from the household surveys

Variable	2018/19			2021/22		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Grade 1 children						
Currently receiving school meals (%)	1984	3.0***	17.0	2049	24.0	43.0
% of urban children receiving school meals	965	6.0***	24.0	996	50.0	50.0
% of rural children receiving school meals	1019	0.1	3.0	1053	0.1	3.0
% of children from emerging regions who receive school meals	313	0.6	8.0	358	0.0	0.0
Any financial/material support (%)	**1985**	**9.0*** **	**28.0**	**2045**	**15.0**	**36.0**
% of urban beneficiaries of support	966	16.0***	36.0	992	28.0	45.0
% of rural beneficiaries of support	1019	2.0	14.0	1053	3.0	16.0
Types of supports		0.0	0.0	0	0.0	0.0
Fee waivers (%)	191	3.0	18.0	312	4.0	20.0
Scholarship assistance (%)	189	4.0*	19.0	312	1.0	10.0
Financial support for girls (%)	186	5.0	22.0	312	3.0	16.0
Financial support for children with disabilities (%)	186	1.0	10.0	312	2.0	13.0
Uniforms and school equipment (%)	188	88.0	33.0	312	92.0	27.0
Other education assistance (%)	188	6.0***	25.0	312	15.0	36.0
Sources of support		0.0	0.0	0	0.0	0.0
Government organisations (%)	173	28.0	45.0	312	92.0	27.0
NGOs/charities (%)	173	61.0	49.0	312	5.0	21.0
Other sources including relatives	173	11.0	31.0	312	3.0	16.0
Grade 4 index children						
% currently receiving school meals	1908	4.0***	19.0	1482	25.0	44.0

Share of urban students (%)	895	7.6***	26.5	706	53.0	50.0
Share of rural students (%)	1013	0.2	4.4	776	0.1	4.0
Share of students from emerging regions (%)	268	0.4	6.1	270	0.1	8.6
Any financial/material support (%)	1909	11.0***	31.0	1483	16.0	37.0
Support among urban students (%)	896	18.0***	38.0	705	31.0	46.0
Support among rural students (%)	1013	5.0***	21.0	778	2.0	15.0
Types of supports						
Fee waivers (%)	214	4.0	20.0	242	3.0	18.0
Scholarship assistance (%)	212	5.0*	22.0	242	1.0	9.0
Financial support for girls (%)	212	6.0	24.0	242	2.0	14.0
Financial sup. for children WD (%)	213	3.0	17.0	242	2.0	13.0
Uniforms and school equipment (%)	212	85.0***	36.0	242	95.0	22.0
Other assistance (%)	210	11.0	31.0	242	8.0	28.0
Sources of support						
Government organisations (%)	210	29.0***	46.0	238	92.0	27.0
NGOs/charities (%)	210	61.0***	49.0	238	5.0	23.0
Other sources (%)	210	10.0***	30.0	238	3.0	17.0

Note: ***, **, & * denotes 1%, 5%, and 10% statistically significant mean differences between 2018/19 and 2021/22 rounds

3.1.4 Progress in system strengthening for policy design and reform

GEQIP-E supports schools for the collection of timely and reliable data on education resources such as textbooks (through EMIS), and on students' learning outcomes through EGRAs and NLAs (Hoddinott *et al.,* 2019). The programme also aims at enhancing the capacity to integrate and analyse data obtained from different sources, for policy formulation and reform (MoE., 2018). Accordingly, we collected information relating to system strengthening through the principals' survey, such as whether or not the sample schools use EMIS. The share of EMIS user schools declined from 83% to 76% (Table 8). While the responsibility of EMIS continues to fall on the principal of the school, the share of administrative staff involved in EMIS increased from 2% to 17%.

There is also lack of access to EMIS-related training. Only 50% of those responsible for EMIS reportedly received the required training in both periods. According to the principals, challenges related to EMIS include: it is time intensive (39% in 2018/19, 24% in 2021/22) and is an additional responsibility for supervisors; lack of access to EMIS-related training (19% in 2021/22); and a lack of guidance (16% in 2018/19, 14% in 2021/22). Limited access to internet connections and working computers are other challenges which also affect the functioning of the system. As

reported in Table 5 above, only 28% of the schools have access to the internet and only 40% of the schools have working computers for students to use. Given the decline in the share of EMIS user schools, and the lack of access to internet connections and computers in most rural schools, gathering accurate information about education resources to overcome the constraints on a timely basis could be challenging.

Table 8: The status of EMIS use across the schools

Variable	Obs	Mean	Std Dev	Obs	Mean	Std Dev
The school provides information to EMIS (%)	76	83.0	38.0	76	76.0	43.0
Person responsible for EMIS						
Principal (%)	63	81.0	40.0	58	71.0	46.0
Vice principal (%)	63	2.0*	13.0	58	9.0	28.0
Member of administrative staff (%)	63	2.0***	13.0	58	17.0	38.0
A designated teacher (%)	63	3.0	18.0	58	2.0	13.0
A combination of the above (=1)	63	13.0*	34.0	58	2.0	13.0
Person responsible receives EMIS training *(%)*	63	49.0	50.0	58	50.0	50.0
Challenges (among EMIS users schools)			0.0	0	0.0	0.0
No challenges (%)	62	26.0	44.0	58	40.0	49.0
Process was time consuming (%)	62	39.0*	49.0	58	24.0	43.0
No training was available (%)	62	7.0**	25.0	58	19.0	40.0
Lack of clear guidance (%)	62	16.0	37.0	58	14.0	35.0
A combination of the above (%)	62	13.0*	34.0	58	3.0	18.0

Source: Principal surveys (2018/19 and 2021/22). Note: ***, **, & * denotes 1%, 5%, and 10% statistically significant mean differences between 2018/19 and 2021/22 rounds

3.2 GEQIP-E and value-added learning in early numeracy in Grade 1

This subsection provides a descriptive analysis of Grade 1 students' early numeracy achievement in relation to GEQIP-E. The value-added in numeracy was analysed in 2021/22 and further explored by gender, and location of residence (Table 9[9]). Value-added is compared by classifying schools into two: those with principals who had received training or specific information about GEQIP-E (hereafter known as the well-informed principal) and those where the principal is not well-informed about GEQIP-E.

[9]The results are also presented in bar graphs in Annexes 1-3

Analysis of the 2021/22 data shows a significant positive association between the value-added of children enrolled in schools with well-informed principals. In these schools, the value-added grew by 11 percentage points but in schools where principals were not well-informed value-added increased by 6.9 percentage points (the difference between the two groups was significant at 1%). Disaggregation of the analyses by gender further shows that girls in schools with well-informed principals registered larger value-added in numeracy relative to girls in schools where principals were not well-informed (this was not the case for boys). Disaggregation by locality also shows significantly larger value-added in rural schools with well-informed principals relative to other rural schools where the principal was not well-informed. These results point to a positive association between the indicator for GEQIP-E information by principals and value-added in numeracy.

Table 9: The value-added in early numeracy of Grade 1 students in 2021/22

Variable	Principal is well informed about GEQIP-E					
	No			Yes		
Boys and girls	Obs	Mean	SD	Obs	Mean	SD
Score at the beginning of the school year	958	71.7***	25.1	1093	67.6	28.9
Score at the end of the school year	816	79.7	21.4	994	79.5	20.5
Value-added in test scores in the school year[10]	816	6.9***	25.0	994	11.0	25.9
Boys						
Score at the beginning of the school year	485	72.4	25.7	540	70.2	28.4
Score at the end of the school year	414	80.9	20.5	487	81.1	18.8
Value-added in test scores in the school year	414	7.7	25.0	487	9.3	24.8
Girls						
Score at the beginning of the school year	473	71.0***	24.5	553	65.1	29.1
Score at the end of the school year	402	78.4	22.3	507	77.9	21.9
Value-added in test scores in the school year	402	6.1***	24.9	507	12.6	26.9
Urban						
Score at the beginning of the school year	495	79.8	21.8	503	81.9	22.5
Score at the end of the school year	453	88.4***	14.4	482	90.3	11.2
Value-added in test scores in the school year	453	8.3	19.6	482	8.0	18.2
Rural						
Score at the beginning of the school year	463	63.0***	25.6	590	55.5	28.4
Score at the end of the school year	363	68.8	23.7	512	69.3	22.1
Value-added in test scores in the school year	363	5.1***	30.3	512	13.9	31.2

[10]There are some students who miss one or other of the two exams in the year. Thus, the value-added is not exactly equal to the differences reported at the beginning and end of the school year. The value-added will be equal to the differences between the percentage scores at the beginning and end of the school years if those who miss either of the exams are excluded.

Note: ***, **, & * denotes 1%, 5%, and 10% statistically significant mean differences between the two comparable (YES/NO) groups

3.3 GEQIP-E and value-added learning in Grade 4 mathematics

In this section the value-added learning in Grade 4 mathematics (measured in IRT scale) is analysed in relation to GEQIP-E by classifying the schools based on whether or not the principal was well-informed principal about GEQIP-E. As with the analyses for Grade 1 students, the scores are investigated by gender and location of residence (Table 10[11]). Results show that the value-added in schools led by well-informed principals is significantly larger than in schools where principals were not well-informed (35 vs 21, $p<0.01$). Disaggregation by gender shows a significant positive relationship between value-added in schools where principals were well-informed. Analysis by location shows a significant positive relationship between value-added and schools having a principal who is well-informed about GEQIP-E.

Table 10: Grade 4 students' mathematics test scores (in IRT) in 2021/22

Variables	Principal is well informed about GEQIP-E					
	No			Yes		
	Obs	Mean	S Dev	Obs	Mean	S dev
Boys and girls						
Score at the beginning of the school year	680	482.6***	87.4	788	465.5	87.3
Score at the end of the school year	627	507.3	96.3	718	500.4	93.8
Value-added in test scores in the school year	627	21.0***	73.5	718	34.5	82.7
Boys						
Score at the beginning of the school year	328	484.6**	84.8	398	468.0	87.9
Score at the end of the school year	298	506.8	95.4	369	499.5	94.3
Value-added in test scores in the school year	298	19.4*	75.5	369	31.2	82.7
Girls						
Score at the beginning of the school year	352	480.8***	89.9	390	462.8	86.7
Score at the end of the school year	329	507.7	97.3	349	501.3	93.3
Value-added in test scores in the school year	329	22.4***	71.7	349	38.0	82.6
Urban						
Score at the beginning of the school year	353	508.7	86.2	349	514.0	86.9
Score at the end of the school year	337	535.1	100	336	547.4	99.1
Value-added in test scores in the school year	337	22.5	69.2	336	31.0	83.8
Rural						

[11]bar graphs are also presented for Grade 4 students mathematics test score for 2021/22 academic year by gender and location of residence (see Annexes 4-6)

Score at the beginning of the school year	327	454.5***	79.7	439	426.9	65.7
Score at the end of the school year	290	474.9***	80.4	382	459.0	65.2
Value-added in test scores in the school year	290	19.2***	78.2	382	37.6	81.7

Note: ***, **, & * denotes 1%, 5%, and 10% statistically significant mean differences between the two (YES/NO) groups

4. Regression Analysis

This section presents the regression analysis for the value-added learning outcomes in the 2021/22 academic year. As stated in sections 2.1 and 2.2, learning losses were reported during the GEQIP-E period due to the combined impacts of COVID-19 and the conflict. The estimation conducted by pooling the baseline and endline data shows a significant negative estimate in both Grade 1 and Grade 4 learning outcomes (Annex 7). The lower levels of numeracy achievement and lower value-added in numeracy are potentially the result of the interruptions in school sessions caused by the pandemic and conflict; delay in the implementation of education enhancement programmes such as GEQIP-E; and, in some instances, the destruction of classrooms and learning facilities. To better understand the effects of the school closures on students' learning levels, as well as their progress over the academic year after schools reopened, refer to Araya *et al.,* (2022). Attrition due to the interruption of the survey is the other challenge (see section 2.3 above). The regression analysis is, therefore, conducted using data from 2021/22 only. The intervention indicators are introduced in the analysis in a stepwise manner, as there is a high correlation between them.

In addition to the individual indicators of GEQIP-E, a total of five indexes are constructed from the bundle of related GEQIP-E interventions using the method of principal component analysis. These include: the O-class index; the GEQIP-E information index; the GEQIP-E training and supervision index; the gender-friendly index; and the disability-friendly index. The lists of indicators used to construct them are presented in Table 11. The indexes take positive and negative values as seen in Table 12. It has to be noted that scores at the beginning of the school year[12] matter in analysing the value-added, which may be associated with the indicators of GEQIP-E implementation. For students who score highly at the beginning of the school year, there cannot

[12]In the next regression analysis section, the bias is minimised by the score at the beginning of the school year.

be much value-added at the year end because there is a ceiling to the highest score. Thus, the results from regression analyses need to be considered with this caveat.

Table 11: Components of GEQIP-E related indexes

The O-Class index
• Number of recruited O-class teachers from within and outside the school
• The proportion of O-class teachers who had received O-class specific training
• Access to training for O-class provision.
GEQIP-E information index
• School principals' awareness of GEQIP-E
• School principals' access to specific information or training relating to GEQIP-E.
GEQIP-E supervision and training index
• Continuous school-based professional development activities (=1)
• Teachers' participation in professional development activities (=1)
• Visits by supervisors and key teachers from cluster schools (=1)
Gender equity index
• Girls' Clubs in the school (=1)
• The SIP has gender-friendly provisions (=1)
Special needs friendly index
• The SIP has disability-friendly provisions (=1)
• Access to teachers' training on how to teach students with disabilities (=1)
• Provision of teaching & learning materials specifically designed for children with disabilities

Table 12: GEQIP-E related indexes in 2021/22 (summary statistics)

Variable	Obs	Mean	Std. Dev.	Min	Max
GEQIP-E information index	76	0.00	1.14	-3.14	0.87
GEQIP-E training index	76	0.00	1.25	-2.89	1.14
O-Class index	76	0.00	1.28	-1.79	1.97
Gender equity index	76	0.00	1.15	-3.04	0.65
Special needs friendly school environment index	76	0.00	1.32	-1.47	2.89

4.1 Regression of the value-added in early numeracy achievement in Grade 1

The regressions of Grade 1 students' value-added learning in early numeracy, measured by percentage point differences between the scores at the beginning and end of the school year, are presented in Tables 13-14. The former reports the estimates of individual measures of GEQIP-E

such as preschool enrolment, school principals' awareness of GEQIP-E, and their access to training/specific information about GEQIP-E. The later introduce estimations using indices for GEQIP-E indicators.

Table 13 shows that preschool enrolments in private and public schools are both positive and significant. Larger marginal effects are reported for preschool enrolment in private schools which is consistent with our expectation. Private preschools (also known as kindergartens) are predominantly located in urban areas and children enroll continuously from ages of 4 to 6 years. Public preschools, on the other hand, are largely O-class type where children spend one year in school before officially starting Grade 1. Enrolment in community or religious schools is also positive but not significant. The provision of the revised, in-service training to O-class teachers is another preschool related intervention that has significant positive associations with early numeracy value-added in Grade 1.

School principals' awareness of GEQIP-E as well as their access to training or detailed information about the content of the reforms are also found to have a significant positive association with early numeracy gains. Continuous professional development activities in schools including leadership training are also positive and significantly associated with value-added in Grade 1 numeracy. The estimates are associational and suggest only a relationship between the types of schools where principals are aware of GEQIP-E, professional development opportunities for teachers and higher value-added in Grade 1 numeracy. Visits by supervisors' and key teachers' from cluster schools, on the other hand, were not significant in terms of value-added in early numeracy scores.

The score at the beginning of the academic year is negative as expected, and statistically significant. It implies that those who score high at the start of the academic year are likely to have lower value-added than those who score low. Since the score at beginning of the year explains a larger variation in value-added learning, the incremental R-squared shows the proportion of the variation explained by the other correlates of numeracy. The results suggest that over 55% of the variations in early numeracy are explained by controlled covariates (47% by the numeracy score at the beginning of the school year, and about 8% jointly by the other covariates).

In terms of the child-related characteristics, the male dummy is positive and significant, indicating a large disparity in learning outcomes between boys and girls. Equity in learning between the genders is among the top priorities of GEQIP-E and the observed significant differences highlight the need for further efforts to address the problem in Grade 1 students. The age of the child is also positive in all regressions, but is significant in two out of six regressions. This association may be capturing the role played by the growth in physical and mental capacity as children get older. From the household-related characteristics, the size of children under 5 years old in the household is significantly negative in all regressions. In households with multiple offspring, the index children might spend several hours at home looking after their siblings, which, in turn, could compromise the index child's on-time enrolment in preschool and primary education, as well as their learning outcomes when they enrol in primary schooling.

Children of urban households are found to have significantly larger learning gains than their rural counterparts. This result may reflects the better learning environments in urban schools, and urban households' improved attitude towards educating their children. The estimates of wealth quintiles also suggest that Grade 1 children from households in the 2nd, 4th, and 5th wealth quintile, in general, perform better than those from households in the 1st wealth quintile. The estimates of urban dummy and wealth quintiles, therefore, suggest much effort needs to be made to reduce the disparity in education outcomes between urban and rural, as well as between affluent and less-affluent Grade 1 children.

Table 13: Regressions of value-added in Grade 1 students' numeracy achievements based on GEQIP-E indicators in 2021/22

	(1)	(2)	(3)	(4)	(5)	(6)
Enrolment in private preschool (=1)	4.4***					
	(3.41)					
Enrolment in public preschool (=1)	3.7***					
	(3.43)					
Enrolment in community/religious preschool (=1)	4.74					
	(1.65)					
O-class teachers received the revised in-service training (=1)		6.4***				
		(7.785)				

School principals' awareness of GEQIP-E (=1)			6.8***			
			(3.5)			
School principal received GEQIP-E related information/training (=1)				2.2***		
				(2.68)		
School-based continuous professional development activity held in schools (=1)					7.3***	
					(8.4)	
Visits by supervisors and key teachers from cluster schools (=1)						1.34
						(0.89)
Test score at the start of school year	-0.8***	-0.75***	-0.8***	-0.8***	-0.8***	-0.7***
	(-38.7)	(-38.57)	(-38.6)	(-38.7)	(-39.4)	(-38.7)
Male child (=1)	1.63**	1.547*	1.7*	1.6**	1.63**	1.60**
	(2.02)	(1.943)	(1.8)	(1.9)	(2.05)	(1.98)
Age of the child	0.85**	0.588	0.63	0.63	0.95**	0.59
	(2.0)	(1.475)	(1.54)	(1.52)	(2.25)	(1.42)
Household size (family members aged 5 years & older)	0.34	0.351	0.350	0.411	0.39	0.39
	(1.20)	(1.242)	(1.2)	(1.4)	(1.39)	(1.355)
Number of children under 5 in the household	-1.2**	-1.045*	-1.2**	-1.15**	-1.042*	-1.082*
	(-2.0)	(-1.823)	(-2.12)	(-1.98)	(-1.86)	(-1.86)
Urban residence (=1)	13***	14.46***	13.2***	13.7***	12.4***	13.7***
	(10.6)	(12.07)	(10.99)	(11.3)	(10.47)	(11.1)
Second wealth quintile (=1)	2.8*	3.489**	2.9*	3.42**	4.6***	3.09*
	(1.73)	(2.187)	(1.80)	(2.08)	(2.80)	(1.90)
Third wealth quintile (=1)	0.26	1.179	0.18	1.02	2.38	0.54
	(0.16)	(0.720)	(0.10)	(0.61)	(1.45)	(0.32)
Fourth wealth quintile (=1)	2.37	3.466**	2.71	3.6**	4.7***	3.2*
	(1.43)	(2.133)	(1.62)	(2.17)	(2.9)	(1.91)
Fifth wealth quintile (=1)	3.6**	5.114***	4.3***	4.3***	5.8***	4.6***
	(2.3)	(3.246)	(2.7)	(3.03)	(3.7)	(2.9)
Constant	44.0***	42.50***	41***	45***	39***	46***
	(10.7)	(11.06)	(9.5)	(11.31)	(9.6)	(10.84)
Observations	1,805	1,810	1,810	1,810	1,810	1,810
R-squared	0.554	0.57	0.555	0.553	0.570	0.551
Incremental R-Squared (except lagged score)	0.08	0.09	0.08	0.08	0.09	0.08

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

In Table 14, indexes are used as explanatory variables instead of the individual indicators of GEQIP-E. The results show positive and significant estimates for the four indexes with the exception of the gender equity index. The results suggests that the various components of GEQIP-E reforms are significantly associated with better learning outcomes, by improving internal

efficiency, education quality, and by reducing the disparity in access to education services between children with and without disabilities. The gender equity dummy is not significant whereas the gender dummy is significant. Gender-focused interventions focus on children in Grade 5 and above, despite the existing disparity at Grade 1. Therefore, there is a need to properly implement gender-related programmes at lower primary grades to reduce the disparity between boys and girls. The findings in Table 13 and 14, in sum, suggest that the individual, as well as the aggregate measures of GEQIP-E, are indispensable in enhancing the early numeracy of Grade 1 students.

Table 14: Regressions of value-added in Grade 1 students' numeracy achievements based on GEQIP-E indexes in 2021/22

VARIABLES	(1)	(2)	(3)	(4)	(5)
O-class index	1.84***				
	(6.01)				
GEQIP-E information index		1.6***			
		(3.8)			
GEQIP-E training index			1.7***		
			(5.1)		
Gender equity index				0.114	
				(0.292)	
Special needs friendly school environment index					1.28***
					(3.9)
Test score at the start of school year	-0.76***	-0.76***	-0.77***	-0.77***	-0.77***
	(-38.77)	(-38.71)	(-38.82)	(-38.62)	(-38.71)
Male index child (=1)	1.61**	1.52*	1.61**	1.59**	1.56*
	(1.98)	(1.9)	(2.0)	(1.962)	(1.935)
Age of the index child	0.485	0.681*	0.821**	0.567	0.759*
	(1.174)	(1.657)	(1.965)	(1.368)	(1.798)
Household size (family members aged 5 years & older)	0.426	0.380	0.364	0.398	0.445
	(1.487)	(1.333)	(1.273)	(1.386)	(1.553)
Number of children under 5 years in the household	-1.028*	-1.252**	-1.196**	-1.059*	-0.922
	(-1.773)	(-2.163)	(-2.076)	(-1.821)	(-1.572)
Urban residence (=1)	13.63***	13.48***	13.59***	13.55***	12.28***
	(11.26)	(11.19)	(11.23)	(11.19)	(10.10)
Second wealth quintile (=1)	2.915*	3.324**	3.543**	3.082*	3.171*
	(1.785)	(2.026)	(2.171)	(1.888)	(1.949)
Third wealth quintile (=1)	0.440	0.759	0.948	0.645	0.328
	(0.265)	(0.456)	(0.575)	(0.390)	(0.196)
Fourth wealth quintile (=1)	3.186*	3.255**	3.398**	3.310**	2.865*

	(1.937)	(1.961)	(2.056)	(1.998)	(1.714)
Fifth wealth quintile (=1)	4.549***	4.572***	4.659***	4.728***	4.238***
	(2.876)	(2.867)	(2.938)	(2.978)	(2.633)
Constant	48.02***	46.56***	45.83***	47.52***	46.98***
	(12.27)	(11.86)	(11.66)	(12.14)	(11.98)
Observations	1,810	1,810	1,810	1,810	1,810
R-squared	0.552	0.555	0.558	0.551	0.554
Incremental R-Squared (except lagged score)	0.08	0.08	0.08	0.08	0.08

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.2 Regressions of the value-added in mathematics test scores in Grade 4

Tables 15 shows the regressions of the value-added (in IRT) for Grade 4 students based on the individual indicators of GEQIP-E in 2021/22. Principals' awareness of GEQIP-E is positive and significant. It suggests that students who attend schools led by GEQIP-E aware principals scored about 24.2 points (p<0.01) higher value-added than those in schools led by principals who were unaware of GEQIP-E. Interestingly, the bivariate association between principals being well-informed about GEQIP-E and value-added found in section 3.2 is no longer statistically significant in the multivariate regression. Professional development by school principals is positive and statistically significant and associated with value-added in numeracy. Visits by supervisors and key teachers from cluster schools are also positive and significantly associated with value-added in numeracy. The estimated parameter suggests that students in schools visited by supervisors had 39 points higher value-added, on average, relative to students in schools not visited by supervisors.

The percentage of Grade 4 mathematics teachers who correctly answered maths questions is the other key variable which has a significant positive association with value-added in Grade 4 students' test scores. This shows the key role of teachers' subject matter knowledge in pupils' learning outcomes, which in turn supports the argument for continuous teacher training to improve their capacity. The score at the beginning of the school is negative as expected and significant. It is also found to explain about 13% of the variations in value-added learning, whereas the other covariates jointly explain about 5%.

From the child-related characteristics, gender is not significant, and may be an indication of decreases in gender disparity between boys and girls in Grade 4 which needs to be maintained

continuously. Age is negative and significant in the value-added probably due to over-aging for grade[13]. From the household characteristics, the number of children under the age of 5 in the household is negative and significant. The presence of multiple young children in the household is likely to increase the demand for child labour in the form of looking after younger siblings. This, in turn, increases class absenteeism and decreases the time spent studying, thus affecting their educational achievement.

The urban dummy is positive and significant in both survey years, as in the regression for Grade 1 children's value-added. This shows the disparity in learning environments between urban and rural schools is reflected in differential learning outcomes between urban and rural students. The estimates of wealth quintiles, on the other hand, suggest that Grade 4 children from households in the first wealth quintile tend to perform better than those from households in the 2nd and 3rd wealth quintile. This is also consistent with the equity objective of GEQIP-E to reduce disparities in the educational outcomes of children from wealthy and poor households.

Table 15: Regressions of value-added in Grade 4 mathematics test scores on GEQIP-E indicators and other covariates in 2021/22

	(1)	(2)	(3)	(4)	(5)
School principal aware of GEQIP-E (=1)	24.2***				
	(3.458)				
Principal received GEQIP-E related info/training (=1)		6.14			
		(1.53)			
School based continuous prof. development activities (=1)			12.7***		
			(3.211)		
Visits by supervisors & key teachers (=1)				39.1***	
				(5.55)	
Maths teachers' test score %					0.195*
					(1.716)
Test score at the start of school year	-0.4***	-0.4***	-0.4***	-0.4***	-0.4***
	(-13.12)	(-12.9)	(-12.87)	(-13.36)	(-12.3)
Male index child (=1)	-4.571	-4.57	-4.559	-4.790	-4.753
	(-1.16)	(-1.16)	(-1.16)	(-1.223)	(-1.211)
Age of the index child	-4.5***	-4.7***	-4.4***	-3.01**	-3.9***
	(-3.003)	(-3.204)	(-3.0)	(-2.00)	(-2.68)
Household size (members 5 years & above)	-0.179	-0.10	0.205	-0.163	-0.131
	(-0.129)	(-0.07)	(0.147)	(-0.118)	(-0.09)
Number of 0-5 year old	-5.40**	-5.36**	-4.91*	-4.49*	-4.25

[13] 60% of the 2018/19 cohort and 40% of the 2021/22 cohort of Grade 4 were over age (11 years old and above) for their grade, despite the fact that students are expected to complete Grade 4 when they are 10 years old.

children					
	(-2.0)	(-1.97)	(-1.808)	(-1.67)	(-1.57)
Urban residence (=1)	21.6***	22.5***	20.8***	25.4***	20.3***
	(4.14)	(4.281)	(3.99)	(4.82)	(3.8)
Second wealth quintile (=1)	-23***	-20***	-17***	-21***	-21***
	(-3.6)	(-3.164)	(-2.75)	(-3.35)	(-3.49)
Third wealth quintile (=1)	-15.8**	-13.4**	-11.25*	-14.7**	-10.35*
	(-2.574)	(-2.158)	(-1.80)	(-2.402)	(-1.71)
Fourth wealth quintile (=1)	-4.411	-2.93	-1.92	-3.366	0.346
	(-0.63)	(-0.417)	(-0.27)	(-0.48)	(0.05)
Fifth wealth quintile (=1)	3.95	5.109	6.25	5.402	6.564
	(0.52)	(0.67)	(0.82)	(0.73)	(0.87)
Constant	246***	263***	252***	216***	241***
	(11.09)	(11.90)	(11.44)	(9.088)	(11.01)
Observations	1,345	1,345	1,345	1,345	1,300
R-squared	0.180	0.175	0.180	0.191	0.164
Incremental R-Squared (except lagged score)	0.053	0.048	0.052	0.063	0.051

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 16 shows the regression of Grade 4 students' value-added in maths tests in 2021/22 for the following GEQIP-E index-based indicators: GEQIP-E information; GEQIP-E supervision and training; gender equity; and disability friendly index. The results suggest that the various components of GEQIP-E reform are significantly associated with better learning outcomes. One possible assumption of the causal pathway for these results is that GEQIP-E may be improving internal efficiency, education quality, and reducing disparities in access to education services for children with and without disabilities.

Table 16: Regressions of value-added in Grade 4 mathematics test scores on GEQIP-E indexes and other covariates in 2021/22

VARIABLES	(1)	(2)	(3)	(4)
GEQIP-E information index	5.12***			
	(3.043)			
GEQIP-E training index		2.626*		
		(1.676)		
Gender equity index			2.9*	
			(1.717)	
Special needs friendly school environment index				4.25**
				(2.42)
Test score at the start of school year	-0.40***	-0.40***	-0.40***	-0.40***

	(-12.94)	(-13.01)	(-13.07)	(-13.08)
Male index child (=1)	-4.733	-4.564	-4.338	-4.413
	(-1.20)	(-1.16)	(-1.1)	(-1.12)
Age of the index child	-4.57***	-4.49***	-4.4***	-4.44***
	(-3.1)	(-3.02)	(-2.91)	(-3.01)
Household size (members 5 years & above)	-0.106	0.018	-0.230	0.13
	(-0.07)	(0.013)	(-0.16)	(0.091)
Number of 0-5 year old children	-5.510**	-4.97*	-4.85*	-4.51*
	(-2.030)	(-1.83)	(-1.78)	(-1.66)
Urban residence (=1)	21.98***	22.38***	21.98***	18.46***
	(4.195)	(4.274)	(4.200)	(3.408)
Second wealth quintile (=1)	-20.6***	-20.6***	-20.8***	-21.9***
	(-3.267)	(-3.247)	(-3.273)	(-3.454)
Third wealth quintile (=1)	-13.63**	-14.24**	-13.48**	-15.47**
	(-2.23)	(-2.31)	(-2.173)	(-2.512)
Fourth wealth quintile (=1)	-3.107	-3.516	-2.70	-5.561
	(-0.44)	(-0.50)	(-0.380)	(-0.79)
Fifth wealth quintile (=1)	5.185	4.434	4.90	1.85
	(0.69)	(0.584)	(0.642)	(0.24)
Constant	265.3***	264.6***	267.4***	269.9***
	(12.22)	(12.06)	(12.26)	(12.38)
Observations	1,345	1,345	1,345	1,345
R-squared	0.179	0.175	0.176	0.177
Incremental R-Squared (except lagged score)	0.052	0.048	0.048	0.05

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

This study explored the progress in the implementation of GEQIP-E, and its association with the educational achievements of Grade 1 and Grade 4 students using RISE's longitudinal survey data collected in 2018/19 and 2021/22. The main outcome variable of interest is the value-added in test scores between the beginning and end of the school year. The key results obtained from the regression analysis of value-added learning in 2021/22 show that preschool enrolment (public as well as private) is significantly associated with larger value-added in early numeracy scores of Grade 1 students. The O-class index is also significantly positive for value-added learning in Grade 1. Principals' awareness of GEQIP-E and school-based continuous professional development activities are significantly associated with larger value-added learning in both grades.

Access to training or specific information about GEQIP-E is significantly associated with larger value-added learning in Grade 1 but not for Grade 4. Similarly, visits by supervisors and key teachers from cluster schools is significantly associated with larger value-added learning in Grade 4 but not for Grade 1. These results are therefore not conclusive of the association of these indicators with value-added, as it is expected that these indicators should be associated with overall improvements in school value-added and not just specific for some grades.

Grade 4 maths teachers' test scores are also associated with larger value-added learning in students in Grade 4, which indicates the need to work on capacity building of school teachers to achieve the intended quality improvements. The estimates for the indexes constructed from the individual GEQIP-E indicators – GEQIP-E information index, GEQIP-E supervision and training index, and disability friendly indexes – are positively associated with larger value-added learning in both grades. On the other hand, the gender equity index is significantly positive only on value-added learning in Grade 4.

From the individual and household characteristics, girls are found to perform poorly compared to boys in in Grade 1, but there is no gender disparity in Grade 4. This is probably because the gender-focused interventions are largely targeted at students in Grade 4 and above. Students from urban areas tend to perform better than their rural counterparts in both grades. In Grade 1 students, household wealth status and learning outcomes are positively related, but they are inversely related

to the value-added in maths test scores in Grade 4. Finally, estimation from the pooled data suggests that learning outcomes have deteriorated between the two survey years, which could be due to the pandemic and the large-scale conflict. Both of these incidents commenced in 2020 and delivered major shocks to the education system.

Recommendations

The findings suggest the following:

- GEQIP-E was not implemented as planned due to disruptions arising from COVID-19, and the conflict, both of which began in 2020. As a result, learning losses were reported over the programme period. Greater efforts and resources are needed to counter the negative effects these two events have had on learning outcomes.
- Though overall improvements in access to textbooks are recorded in both Grade 1 and Grade 4, there is a wide gap between emerging regions and other regions. Proper implementation of SIPs and delivering grants on time to schools could help improve the poor learning environment in the emerging regions.
- The expansion of preschools is taking place largely in urban areas. Emphasis should be given to improving access to preschools in rural and pastoral areas.
- The regression analysis shows that rural children in both grades perform poorly compared to their urban counterparts. This is largely associated with the limited access rural children have to preschools, textbooks, and school meals, among others. The findings suggest that efforts focusing on rural areas need to be strengthened to reduce disparities in learning outcomes between urban and rural areas.

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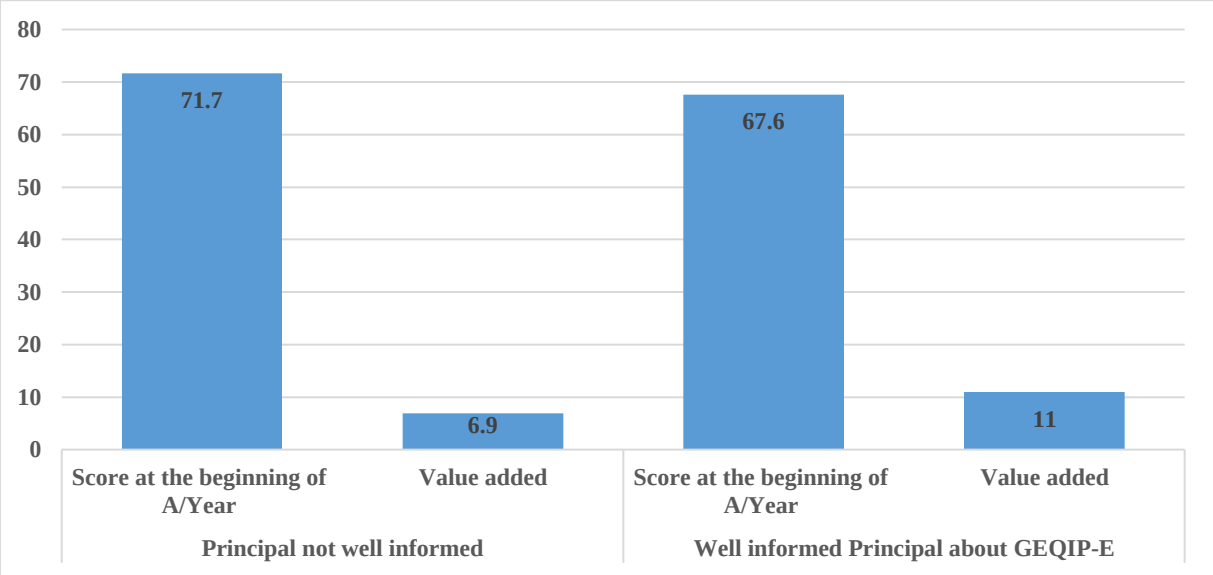
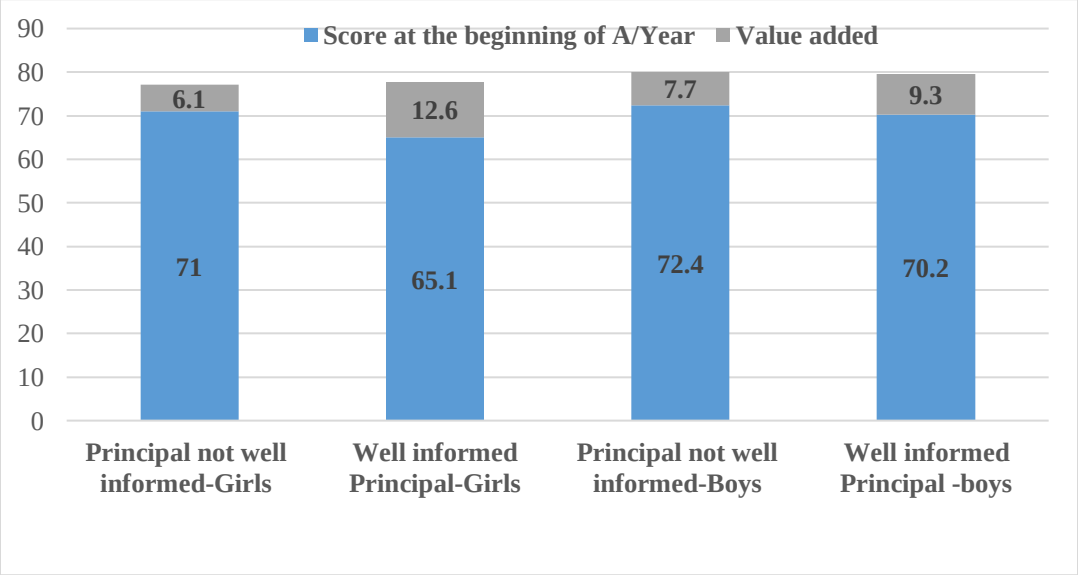
ANNEXES

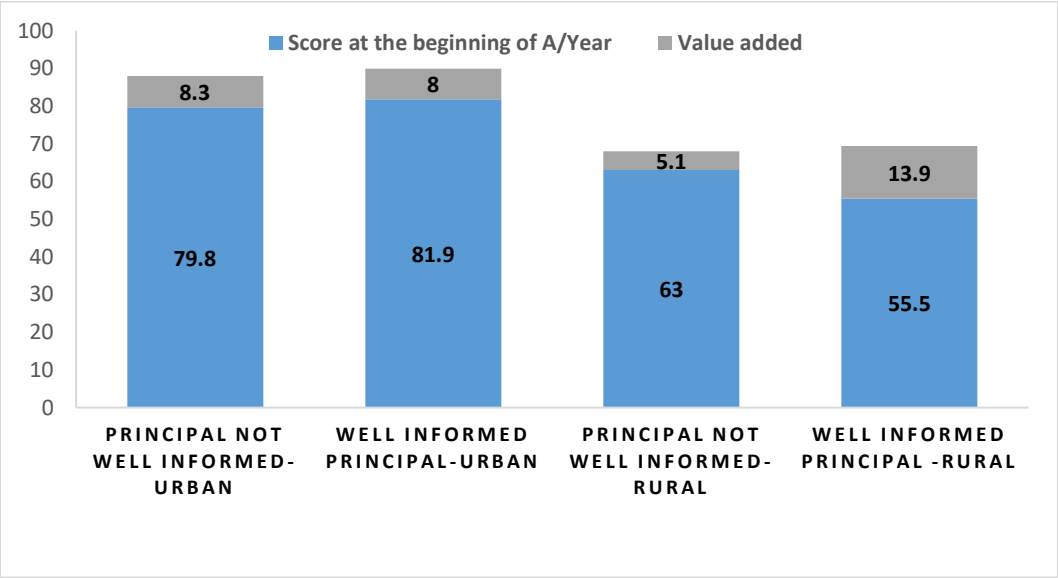
Annex 1: Percentile scores at the year beginning and value-added in early numeracy of Grade 1 children in2021/22



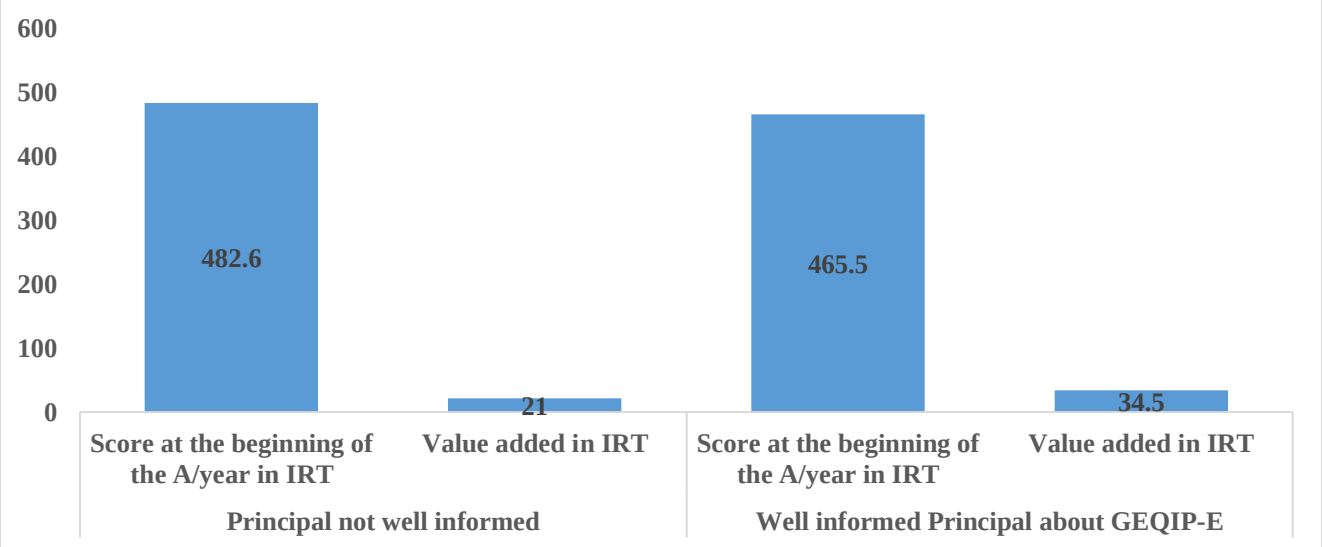
Annex 2: Percentile scores at the year beginning and value-added in early numeracy of Grade 1 children by gender in 2021/22



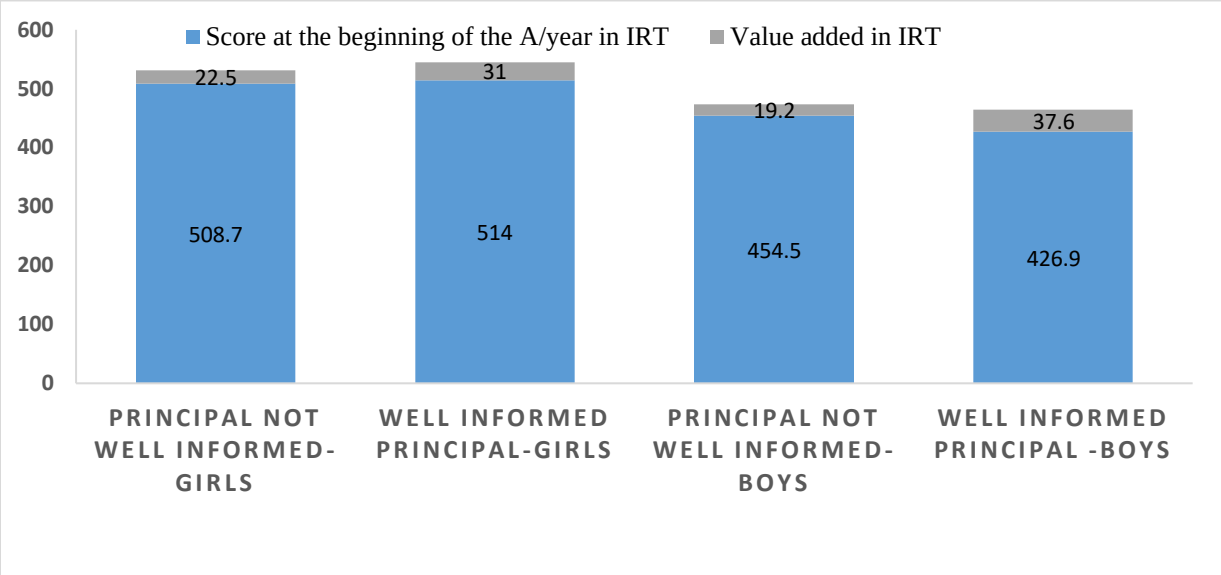
Annex 3: Percentile scores at the year beginning and value-added in early numeracy of Grade 1 children by location in2021/22



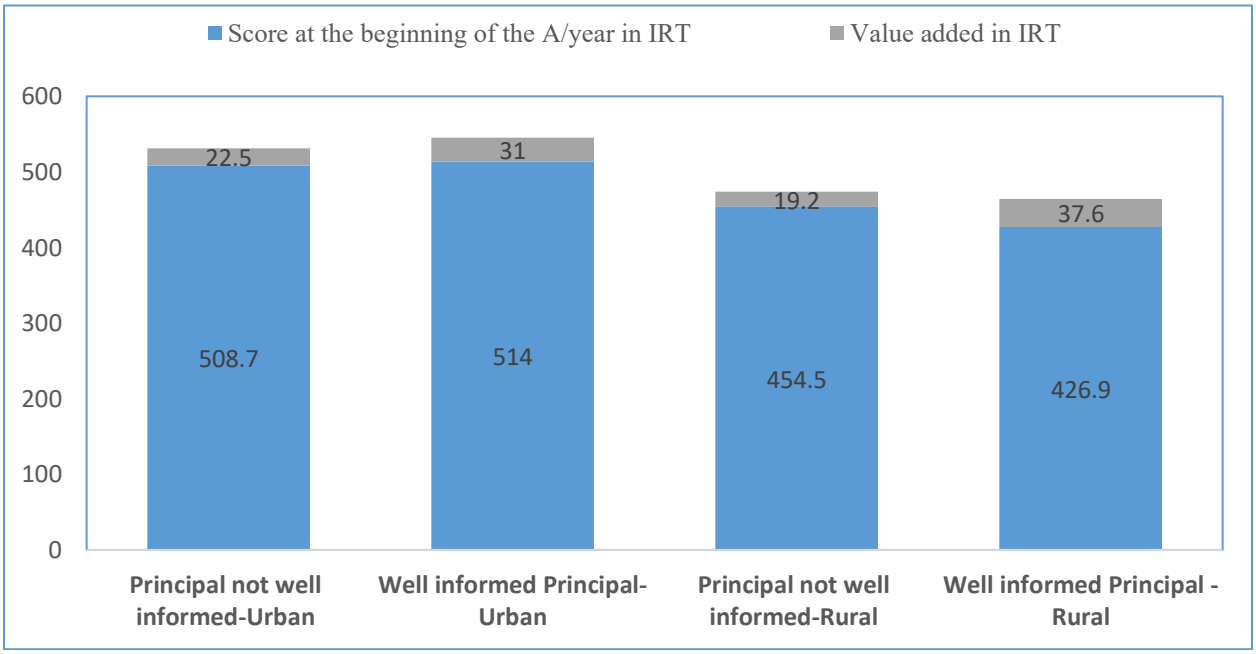
Annex 4: Mathematics score of Grade 4 students in IRT in 2021/22



Annex 5: Mathematics score of Grade 4 students in IRT in 2021/22 by gender



Annex 6: Mathematics score of Grade 4 students in IRT in 2021/22 by location



Annex 7: Regressions of the percentage value-added in Grade 1 numeracy and Grade 4 maths test (in IRT) on pooled data from 2018/19 and 2021/22

	Value-added for Grade 1	Value-added for Grade 4
VARIABLES		
School principal aware of GEQIP-E (=1)	0.86	16.95***
	(0.97)	(4.8)
Grade 4 mathematics teachers' test scores		0.237***
		(2.857)
Test score at the start of school year	-0.8***	-0.28***
	(-44.45)	(-15.80)
Post 2018/19 year dummy (=1)	**-7.5*** **	**-19.12*** **
	(-11.60)	(-6.450)
Male index child (=1)	0.87	0.218
	(1.5)	(0.079)
Age of the index child	0.71***	0.772
	(3.45)	(0.841)
Household size (members aged 5 years & above)	0.173	-0.919
	(0.92)	(-1.023)
Size of 0-5 year old kids in the household	-0.416	-6.37***
	(-1.03)	(-3.835)
Urban residence (=1)	10.4***	23.63***
	(10.71)	(5.785)
Second wealth quintile (=1)	2.340**	-13.3***
	(2.05)	(-3.018)
Third wealth quintile (=1)	0.135	-11.87***
	(0.11)	(-2.628)
Fourth wealth quintile (=1)	0.90	-7.643
	(0.72)	(-1.491)
Fifth wealth quintile (=1)	0.86	-3.918
	(0.67)	(-0.716)
Constant	54.42***	146.0***
	(21.74)	(10.14)
Observations	3,253	2,790
R-squared	0.517	0.115