



From Connectivity to Classroom Impact: How Starlink is Transforming Teaching and Learning in Kenyan Schools

STARLINK



REPUBLIC OF KENYA



Grow X
Education

Acknowledgements

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PART I: EXECUTIVE SUMMARY

Reliable internet connectivity is widely recognized as a critical foundation for equitable access to quality education and broader socio-economic development. Unfortunately, across many contexts in the Global South, limited or unstable connectivity in school systems continues to reinforce existing educational disparities. Without consistent access to digital resources, students and educators are constrained in their ability to participate fully in modern learning environments, develop critical digital competencies, and engage in the knowledge economies that increasingly shape global opportunity (OECD, 2021; UNICEF, 2023; World Bank, 2020).

Within this context, emerging connectivity solutions such as satellite-based internet offer a promising pathway for bridging long-standing infrastructure gaps. By enabling consistent and scalable access to online resources, such technologies have the potential not only to enhance teaching and learning, but also to support broader socio-economic development by unlocking new pathways for economic participation and social mobility.

This study, conducted in partnership between Grow X Education, an educational technology company based in California, USA, and the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) under Kenya's Ministry of Education, examines the early impact and potential magnitude of Starlink connectivity on teaching and learning in Kenyan schools. Using a pre–post intervention design (pre-Starlink: $n = 29$; post-Starlink: $n = 28$), the study provides timely evidence of how reliable internet access can begin to transform educational environments while offering important insights into the broader impact of scaling connectivity solutions across diverse school contexts.

As a pilot, 30 schools across selected districts in Kenya participated in the study. Heads of Institution completed a baseline survey prior to receiving Starlink and a follow-up survey approximately one month after implementation to assess changes in connectivity, teaching practices, and learning behaviors. The introduction of Starlink connectivity resulted in substantial improvements in internet quality, including enhanced reliability, speed, and stability. Schools transitioned from reliance on mobile data and fiber connections to satellite-based internet, which provided more consistent access, faster connectivity, and reduced downtime. These gains were further supported by quicker resolution of technical issues and improved power stability.

Starlink connectivity significantly influenced teaching practices, with a marked increase in both the frequency and scope of digital resource use. Teachers expanded their integration of technology across lesson preparation, delivery, assessment, and remediation. The use of data-driven tools to inform instructional decisions also increased, supported by greater availability of Information and Communication Technology (ICT) support staff and establishment of institutional ICT guidelines.

At the learner level, there was a notable rise in engagement, participation, and digital literacy. Students demonstrated greater independence in accessing online platforms, participating in interactive lessons, and collaborating digitally. Interest in ICT-integrated learning increased significantly, alongside reported improvements in STEM-related performance.

The early impact of Starlink enhanced connectivity extends beyond the classroom, with over half of the participating schools using it to internet access to support parents, community members, local businesses, and after-school programs. Satisfaction with Starlink is notably high, with nearly all Heads of Institution recommending its adoption to other schools in Kenya.

Looking ahead, the expansion of reliable connectivity such as Starlink presents a significant opportunity to strengthen educational outcomes and digital inclusion across Kenya’s school system. However, scaling these efforts will require complementary investments in devices, infrastructure, and teacher capacity. Further research is needed to assess long-term impacts, particularly on student learning outcomes, digital competencies, and equity. Understanding the conditions that maximize the benefits of connectivity will be critical to ensuring sustainable and meaningful improvements in teaching and learning.

PART II: INTRODUCTION

1. SUPPORTING HOLISTIC EDUCATION IN KENYA

Since 2024, the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEА), a national institution under Kenya’s Ministry of Education, has been working closely with Grow X Education, an educational research and technology organization based in California, USA, to support the integration of holistic education approaches aligned with Kenya’s 2019 Competency-Based Curriculum (CBC). Kenya’s CBC educational reform emphasizes not only academic achievement but also the development of social-emotional learning (SEL), critical thinking, creativity, communication, and real-world problem-solving skills necessary for success in the 21st century.

As part of this collaboration, Grow X Education and CEMASTEА have focused on supporting teachers in integrating social and emotional learning practices into Science, Technology, Engineering, and Mathematics (STEM) instruction. In August 2025, the Grow X Education team visited Kenya and worked with over 100 teachers through a series of professional development workshops designed to strengthen Kenyan teachers’ capacity to incorporate SEL principles into classroom teaching and learning. During these sessions, teachers were introduced to the Grow X SEL platform and related instructional approaches intended to support student engagement, collaboration, self-regulation, and holistic development. [\[Read more about our initiative featured on CASEL’s \(Collaborative for Academic, Social and Emotional Learning\) website\].](#)

However, once the Grow X Education research team began working directly with schools on the ground, it quickly became apparent that one of the most significant barriers to implementation was the lack of reliable internet connectivity. Stable and consistent connectivity, critical for effective instruction and student learning, was largely nonexistent. At the same time, the research team witnessed a strong and consistent desire among students, teachers, and school leaders with digital learning opportunities and connect to the broader global community. This contrast made one reality clear: modern education depends on reliable connectivity.

Around the world, connectivity and technology has transformed learning into highly interactive, personalized experiences, with AI tools that extend far beyond traditional classroom resources. Yet, across much of the Global South, including the large regions of African and South Asia, where approximately 75% of the world’s student population lives, reliable internet access remains limited. This lack of connectivity prevents millions of students from fully participating in 21st-century education. The widening digital divide in school systems is not simply a technological gap; it is an opportunity gap. Without innovative, infrastructure-driven solutions, this divide will continue to grow, deepening educational inequities worldwide.

SpaceX, through its Starlink satellite network, is uniquely positioned to help reduce these geographic and technological barriers many students face across the Global South. Using compact satellite internet terminals connected through a low-Earth orbit satellite constellation, Starlink deliver high-speed, reliable internet access, including in most remote and underserved regions where traditional broadband infrastructure has failed to reach. Guided by their mission-driven commitment to expanding digital access across educational communities, SpaceX has been rapidly deploying Starlink systems in areas that have historically been left behind, helping to bridge the connectivity gap and expand new learning opportunities, including within the Kenyan schools highlighted in this report.

2. ABOUT STARLINK BROADBAND

Starlink is the world's most advanced satellite constellation, using thousands of satellites in low-Earth orbit to deliver high-speed, low-latency internet capable of supporting 4K streaming, online gaming, video calls, online education, cloud-based collaboration, and other digital learning activities. Unlike traditional satellite internet systems that rely on single geostationary satellites orbiting approximately 35,786 kilometers above Earth, Starlink satellites orbit much closer to Earth at approximately 550 kilometers. This lower orbital distance significantly reduces latency and enables more reliable real-time internet performance suitable for educational and digital learning environments. Starlink latency can be as low as 25 milliseconds under optimal conditions, compared to 600 milliseconds or higher for conventional satellite systems.

A key feature of the Starlink network is its use of optical space lasers that transmit data throughout the Starlink constellation, enabling continuous service in areas far from its ground stations, including coverage over open oceans and polar regions. The Starlink constellation contains more than 23,000 lasers transmitting over 10Pb of daily data traffic. These lasers are capable of sustaining 100 Gbps connections per link.

Starlink is engineered by SpaceX. As the world's leading provider of launch services, SpaceX is the only satellite operator with the ability to launch its own satellites as needed. With frequent, low-cost launches, Starlink satellites are constantly updated with the newest technology. Leveraging SpaceX's deep experience with both spacecraft and on-orbit operations, Starlink's advanced satellites are produced and operated in Redmond, Washington, and Starlink Kits for customers are manufactured in Bastrop, Texas, all to deliver high-speed, low-latency internet all around the world.

As of 2026, the Starlink constellation includes more than 10,000 active satellites providing global coverage across land, oceans, polar regions, rural communities, and other underserved regions worldwide. After only five years of commercial operation, Starlink has expanded rapidly across the globe and currently serves millions of active users across all seven continents. According to SpaceX, the network connected more than 10 million customers across land, air, and sea environments and expanded service to 35 additional countries and territories during 2025 alone.

Starlink connectivity has increasingly been deployed across educational, humanitarian, rural, and remote contexts where traditional broadband infrastructure remains limited. Within schools, reliable connectivity has the potential to support access to online educational content, digital assessments, communication tools, STEM learning resources, and broader ICT integration efforts. In Kenya, participating schools in this report received Starlink connectivity as part

of broader efforts to strengthen digital access and support technology-enabled teaching and learning environments. Learn more at www.starlink.com and follow [@Starlink on X](https://twitter.com/StarlinkonX).

PART III: METHODOLOGY

This study was conducted through a close collaboration between Grow X Education, an educational technology company based in California, USA, and the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEА) under Kenya’s Ministry of Education. Building on the premise that reliable connectivity can serve as a foundational enabler of educational changes, the study was designed to examine how the introduction of Starlink connectivity influences teaching and learning in real-world school contexts in Kenya. In particular, it sought to capture early evidence of how improved internet access can reduce structural barriers, expand access to digital resources, and support more engaging and effective instructional practices, especially in Science, Technology, Engineering, and Mathematics (STEM) education.

To achieve this, the study employed a pre–post intervention design, centered on a structured Head of Institution (HoI) questionnaire administered at two time points. The baseline (pre-Starlink connectivity) survey included 29 respondents, while the follow-up (post-Starlink connectivity) survey included 28 respondents. Heads of Institution were selected as primary respondents due to their comprehensive oversight of school operations, instructional practices, infrastructure, and data use, allowing for a holistic assessment of school-level change.

Participating schools were identified by CEMASTEА in coordination with district education leaders to ensure representation across diverse geographic, infrastructural, and socio-economic contexts in Kenya. In addition, schools were also required to meet a minimum threshold of available learning devices, ensuring a foundational level of readiness to effectively utilize internet connectivity once deployed. This selection strategy enabled the study to examine both the immediate effects of enhanced connectivity and the conditions under which its impact may be maximized for the future.





Photos from the Starlink Impact Study Kickoff Meeting (February 2, 2026; CEMASTEIA Main Campus in Nairobi, Kenya)

Baseline data collection took place on February 2, 2026, during a national kickoff meeting held at CEMASTEIA campus in Nairobi, Kenya at the beginning of the new academic year. During this session, school leaders were oriented to the study objectives, survey instrument, and data collection procedures prior to completing the baseline questionnaire. The survey instrument was designed to capture a comprehensive picture of pre-connectivity conditions and included three integrated components:

- **Structured school and system characteristics:** Capturing school demographic and institutional characteristics, including location, school type, enrolment, staffing levels, device availability, connectivity type, power infrastructure, and ICT support structures. These items primarily used fixed-response formats (e.g., number of devices), providing a baseline of school readiness and infrastructure.
- **Connectivity, instructional, and outcome measures:** Measuring key indicators related to connectivity quality, frequency of technology use, instructional practices, teacher capacity, learner engagement, academic performance, and data use. These items included a mixture of Likert-type scales, ordinal frequency measures, comparative pre–post perception items, and multiple-response selections such as “tick-all-that-apply”. Together, these captured both the extent and perceived impact of changes associated with Starlink connectivity.
- **Qualitative insights and contextual narratives:** Providing in-depth, contextualized information on school experiences, including institutional support for ICT integration, perceived key enablers, persistent challenges, and changes following connectivity. These open-ended responses allowed for a deeper understanding how connectivity interacts with local conditions and practices that is typically difficult to capture through structured items.

Following baseline data collection, Starlink connectivity was installed in participating schools in early February 2026, with implementation carried out by school-based teams. After approximately one month of continuous connectivity, a follow-up survey was administered during the week of March 16, 2026. The post-Starlink connectivity instrument closely mirrored the baseline survey to enable direct comparison over time, while also incorporating additional items to identify system performance, emerging use cases, and implementation-related challenges.

Data analysis integrated both quantitative and qualitative approaches to provide a comprehensive view of change. Quantitative data were analyzed using descriptive statistics to identify shifts in key indicators between pre- and post-Starlink connectivity, which particular attention to changes in connectivity reliability, technology integration,

instructional practices, and learner engagement. Qualitative responses were analyzed thematically to identify recurring patterns, emerging practices, and contextual factors shaping the use and impact of connectivity on teaching and learning processes.

As an early-stage impact study, the findings are based on self-reported data and a relatively short exposure period to Starlink connectivity. While these factors limit the ability to draw long-term or causal conclusions, the current methodology is intentionally designed to capture early signals of change and improvement in real educational contexts. In doing so, this study provides timely and valuable insights into how connectivity can act as a catalyst for strengthening instructional quality and student engagement during learning, while also highlighting the conditions necessary to scale such impact across diverse educational contexts.

PART III: RESULTS

1. DEMOGRAPHICS

Geographic Distribution of Participating Schools ($n = 29$)

Figure 1.1 presents the geographic distribution of participating schools across Kenya. The map highlights the counties in which the 29 participating schools are located, demonstrating broad representation across the country. The schools are distributed across 28 counties, reflecting a diverse range of geographic, socio-economic, and infrastructural contexts, including urban, semi-urban, and rural settings. This diverse distribution also supports the study’s aim of examining the potential scalability of connectivity solutions across varied educational settings in Kenya.

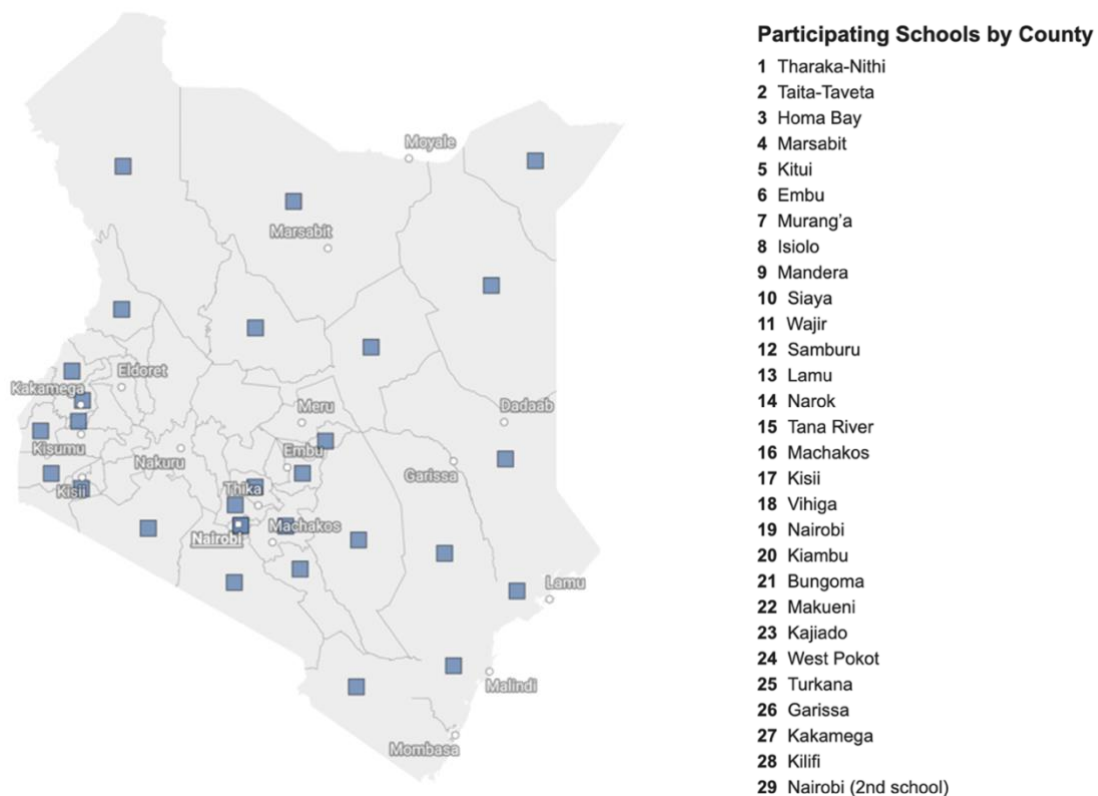


Figure 1.1: Kenyan counties where schools are located

School Category

Figure 1.2 displays that most of the participating schools are senior schools (high schools), making up 69% ($n = 20$) of the total, while junior schools (Elementary and Junior high Schools) account for 31% ($n = 9$).

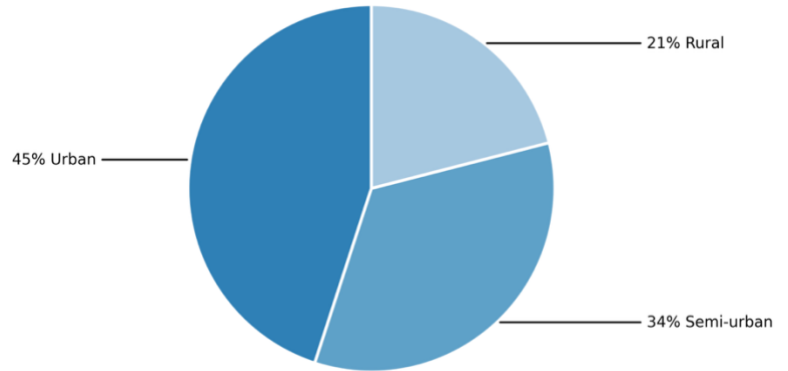


Figure 1.2: School category

School Urbanicity

Figure 1.3 shows that most of the connected schools are in urban areas, accounting for 45% ($n = 13$) of the total. Semi-urban schools make up 34% ($n = 10$), while rural schools represent the smallest share at 21% ($n = 6$). The average number of students per school was 1,144, and the average number of teachers was 40.

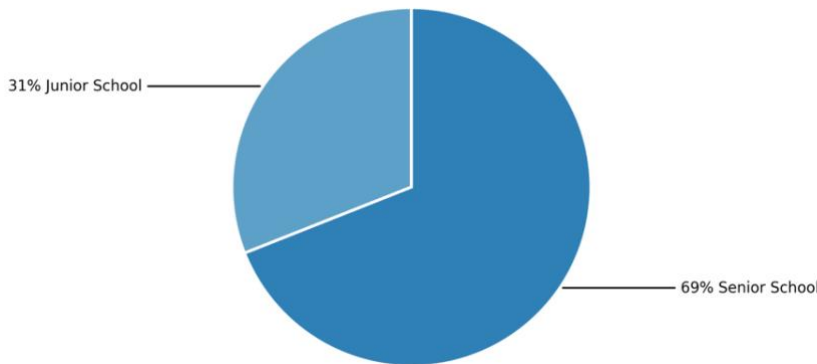


Figure 1.3: School urbanicity

Head of Institution's Gender

The data indicate that most Heads of Institution were male, comprising 68% of the sample, while female respondents accounted for 32% (see Figure 1.4).

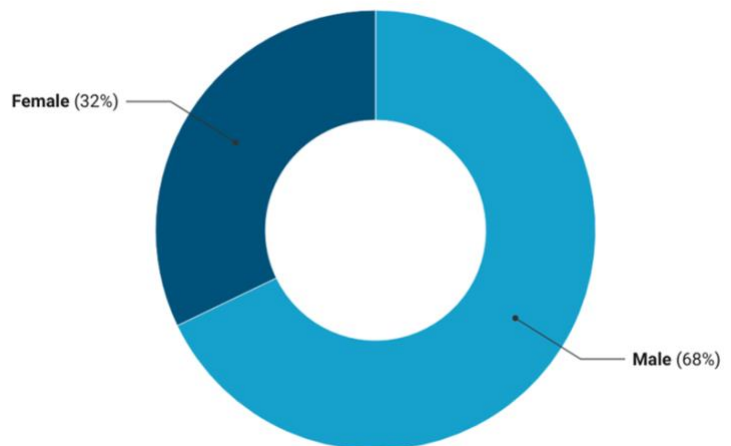


Figure 1.4: Heads of Institution Gender

2. CONNECTIVITY PERFORMANCE

Sufficiency of grid power for continuous internet use at school

Survey findings indicate that schools experienced notable improvement in power reliability following the implementation of Starlink connectivity. As shown in Figure 2.1, the proportion of schools reporting stable grid power increased from 41% to 54%, reflecting greater consistency in electricity supply. At the same time, schools relying on grid power supplemented by backup sources remained relatively stable (from 37% to 36%).

Importantly, the proportion of schools experiencing frequent power outages declined substantially from 22% to 11%. This reduction highlights improved power stability, which is essential for ensuring continuous internet access and maximizing the benefits of enhanced connectivity in teaching and learning environments.

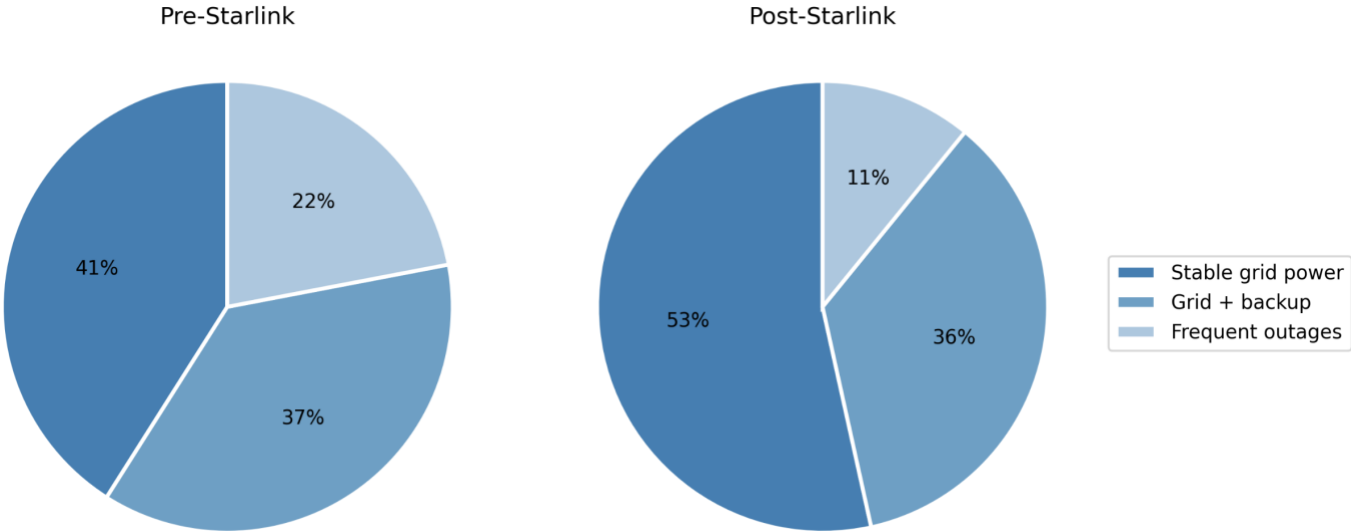


Figure 2.1: Sufficient power to connect

Form(s) of internet access teachers and learners have

The findings indicate a substantial shift in internet access following the introduction of Starlink connectivity. Prior to Starlink, most schools relied on mobile data (67%) and fiber connections (26%), with only minimal use of legacy/non-Starlink satellite (4%) (see Figure 2.2).

Following implementation, Starlink became the dominant mode of internet access, increasing sharply to 88%. At the same time, reliance on mobile data and fiber connections declined significantly, each dropping to 4%. Overall, these results highlight a rapid transition toward satellite-based connectivity, alongside a diversification of internet access strategies across schools.

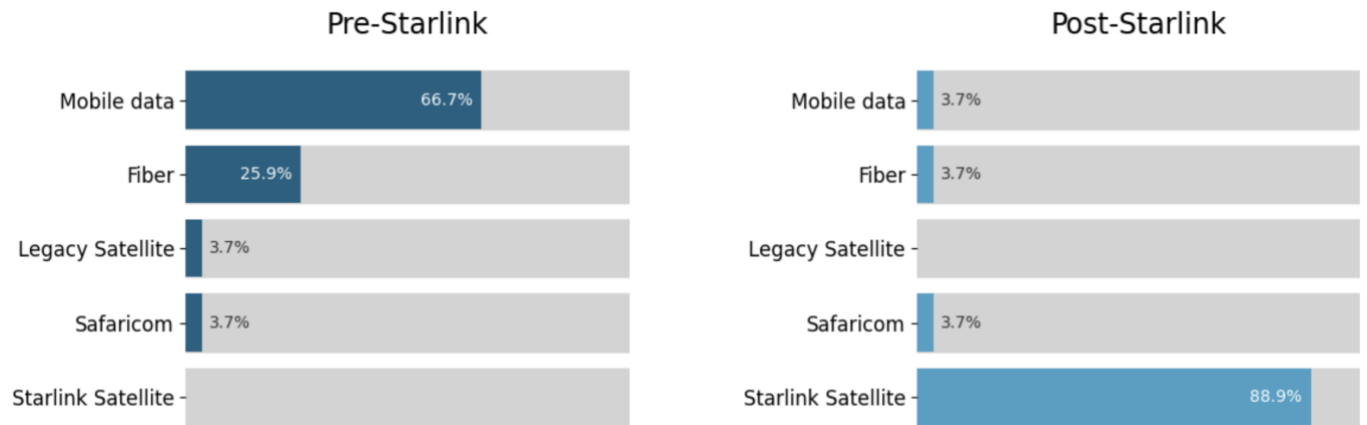


Figure 2.2: Form of internet

Reliability of internet connectivity at school

Figure 2.3 shows a significant improvement in the reliability of internet connectivity following the introduction of Starlink. Prior to the implementation, the majority of schools rated their internet as fairly reliable (61%), while a substantial proportion reported it as unreliable (29%), and none considered it very reliable.

Post-Starlink, perceptions of reliability improved substantially. A combined 61% of schools rated their internet as either very reliable (25%) or reliable (36%). At the same time, the proportion of schools reporting unreliable connectivity declined sharply to 7%. Overall, these changes demonstrate a clear shift toward more stable and dependable internet access across schools.

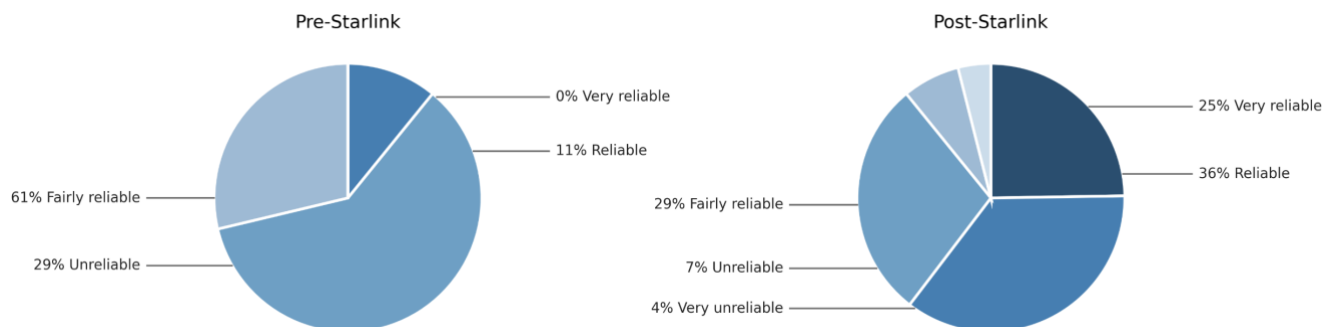


Figure 2.3: Reliability of internet connectivity

A Mann–Whitney U test was conducted to examine differences in perceived internet reliability before and after the introduction of Starlink connectivity. Reliability ratings were treated as ordinal data, ranging from *very unreliable* to *very reliable*. Results showed a statistically significant improvement in perceived reliability following the intervention ($U = 192.0, p < 0.001$). The effect size was moderate to large ($r = 0.47$), indicating a meaningful shift in connectivity quality across participating schools.

Sufficiency of the internet speed for learning activities (e.g., Video, simulations) when available

The findings indicate a substantial improvement in perceived internet speed following the introduction of Starlink technology. As noted in Figure 2.4, prior to the implementation, a majority of schools (54%) reported that internet speed was *mostly not sufficient*, and none (0%) considered it *always sufficient*.

Following implementation, half of the schools (50%) reported that internet speed was *mostly sufficient*, while 18% indicated it was *always sufficient*. At the same time, the proportion of schools experiencing insufficient speeds declined significantly to 14%. Overall, these findings highlight a clear enhancement in internet speed, improving schools' ability to support digital learning activities.

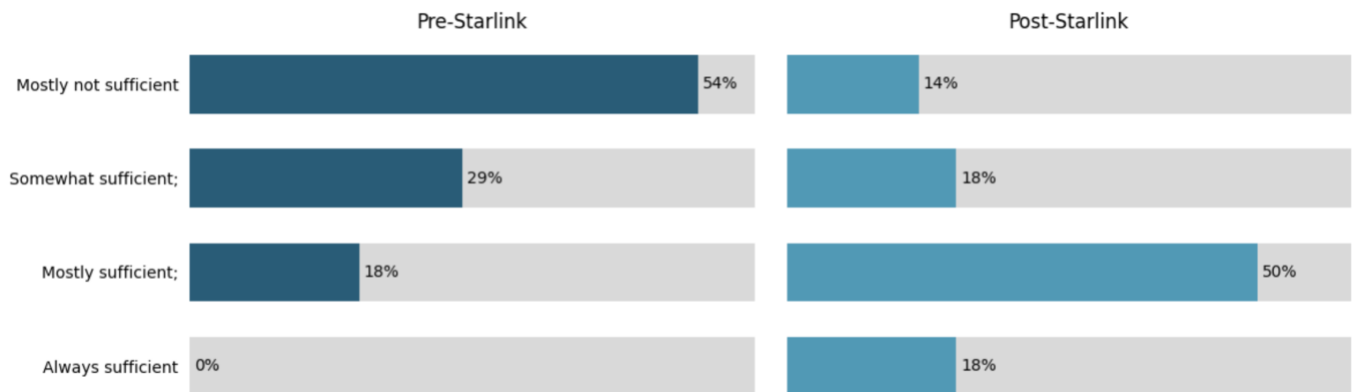


Figure 2.4: Internet speed

A Mann–Whitney U test was conducted to examine differences in perceived internet speed sufficiency for learning activities before and after Starlink implementation. Responses were coded on an ordinal scale from 1 (*mostly not sufficient*) to 4 (*always sufficient*). Results indicated a statistically significant improvement between pre-Starlink and post-Starlink responses, $U = 162.00$, $p < .001$, $r = .52$. These findings suggest that perceptions of internet speed sufficiency improved significantly following the Starlink connectivity.

Average time taken to resolve a connectivity or hardware issues

The survey results indicate that the time required to resolve connectivity or hardware issues improved following the implementation of Starlink. As depicted in Figure 2.5, prior to Starlink connectivity, most issues were resolved *within 1–2 days* (50%), while a smaller proportion were addressed on the *same day* (43%), and no (0%) respondents reported experiencing *no issues*.

After Starlink implementation, resolution time improved noticeably. A greater proportion of schools reported *same-day* resolution (46%), and 21% indicated that they experienced *no issues* at all. The proportion of cases requiring *1–2 days* decreased substantially to 18%, and issues taking *3–5 days* were eliminated entirely.

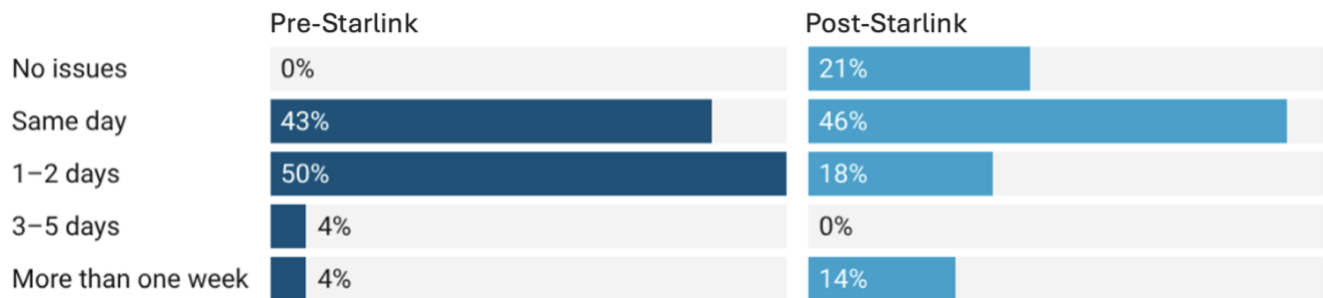


Figure 2.5: Time to resolve connectivity issues

A Mann–Whitney U test was conducted to examine differences in the average resolution time required to between Pre-Starlink and Post-Starlink connectivity. Responses were coded on an ordinal scale from 1 (*more than one week*) to 5 (*no issues*), with higher values indicating faster resolution. The results indicated that resolution times were higher (*faster*) in the Post-Starlink compared to the Pre-Starlink. This difference approached statistical significance, $U = 283.00$, $p = .057$, $r = .26$, suggesting a trend toward faster issue resolution following the implementation of Starlink.

3. HARDWARE DEVICES AND ICT SUPPORT

Average number of devices per school

The survey findings indicate that desktop computers are the most common devices in schools, with an average of 27 per school (see Figure 3.1). Laptops follow at an average of 9 devices per school, while smart screens/TVs and projectors are less common, averaging 3.5 and 3 respectively. Smart boards are the least available, with virtually no presence across schools (average of 0.2 per school). Overall, the results suggest that traditional desktop computers continue to dominate the digital infrastructure in schools.

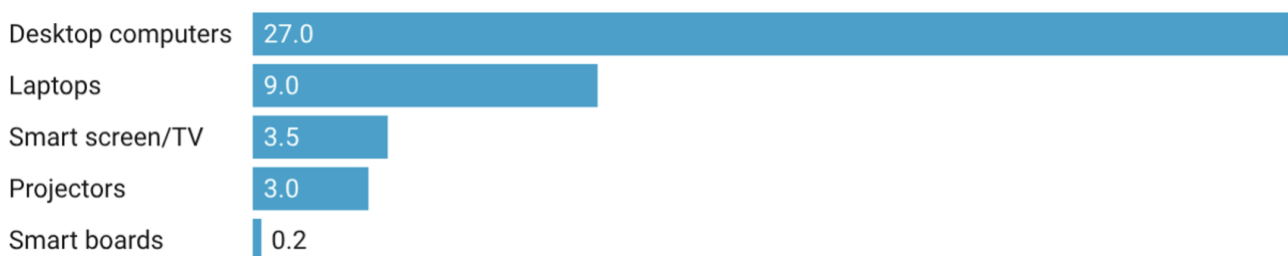


Figure 3.1: Average number of technology devices per school

Approximate learner-to-device ratio for digital learning

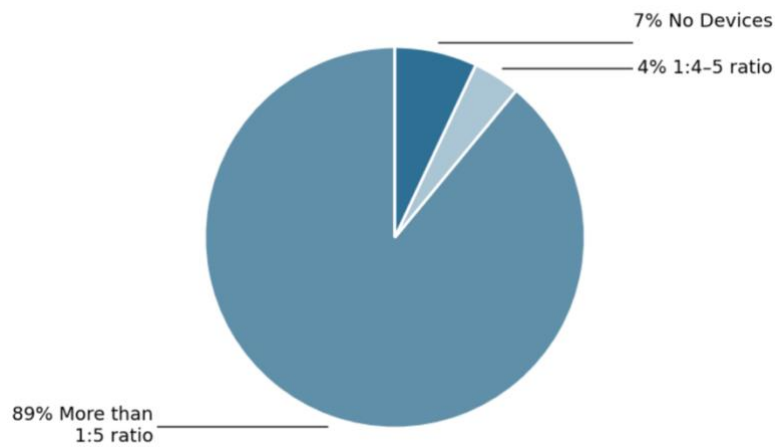


Figure 3.2: Learner-to-device ratio

The data further indicate that access to digital devices remain limited for learners. As shown on Figure 3.2, a large majority of schools (89%) reported that more than five learners share a single device, reflecting high learner-to-device ratios. Only 4% of schools report a more favorable ratio of one device for every 4-5 learners, while 7% indicated that they have no digital devices available. These findings highlight persistent constraints in device availability, which may limit the full utilization of digital learning opportunities.

Teacher's use of mobile phones in the classroom to support teaching

Figure 3.3 depicts that the majority of schools' (86%) teachers are using mobile phones in the classroom, while a smaller proportion (14%) do not.

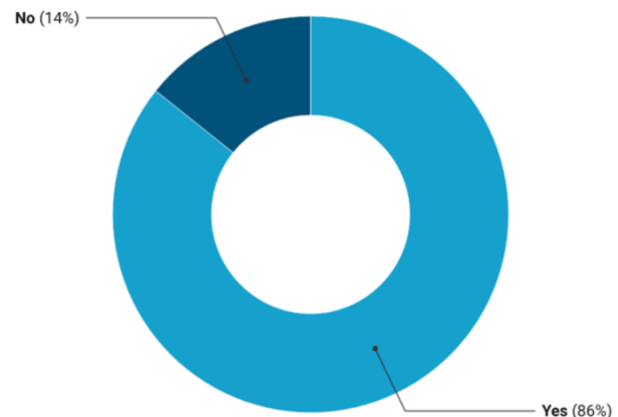


Figure 3.3: Use of mobile phones

Additional devices procured since Starlink connectivity

The findings indicate that a relatively small proportion of schools (15%) have already procured additional devices following the introduction of Starlink connectivity (see Figure 3.4). However, nearly half of the schools (48%) reported that they are in the process of acquiring more devices to further support teaching and learning, while 37% indicated that they have not yet procured additional devices. These results suggest that enhanced connectivity is beginning to influence schools' planning and investment decisions. Many schools are actively responding to increased demand for digital learning by prioritizing the expansion of device availability. Although procurement is

still underway in many cases, this trend reflects a positive shift toward strengthening digital learning environments and aligning infrastructure with enhanced connectivity.

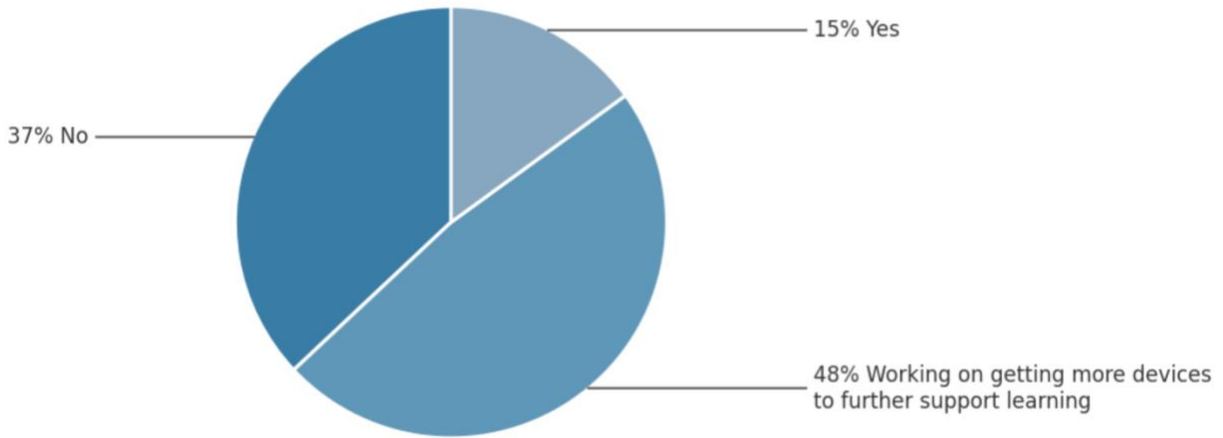


Figure 3.4: Procurement of new devices after Starlink implementation

Existence of Information and Communication Technology (ICT) support, teacher, or a “technical Champion,” at the school

The finding indicates a clear improvement in the availability of ICT support teachers following the introduction of Starlink. Figure 3.5 shows the proportion of schools with full-time ICT support rose from 64% to 79%, while reliance on part-time support declined from 29% to 14%. The share of schools without any ICT support remained unchanged at 7%. Overall, these changes suggest a shift toward more consistent and dedicated full-time technical support within schools, which is likely to strengthen the sustainability and effective use of digital technologies in teaching and learning.



Figure 3.5: Designated ICT support

4. TEACHER'S AND SCHOOL'S INSTRUCTIONAL DIGITAL USE AND NEEDS

Teachers’ use digital resources in the learning process

The results revealed a notable increase in the frequency with which teachers use digital resources following the implementation of Starlink. Figure 4.1 shows the proportion of teachers who use digital tools *often* rose substantially from 57% to 82%. In contrast, those who use them *sometimes* declined from 36% to 18%, while the proportion of

teachers who *rarely* use digital resources dropped from 7% to 0%. Overall, these findings indicate a strong shift toward more frequent and consistent integration of digital tools in the teaching and learning process.

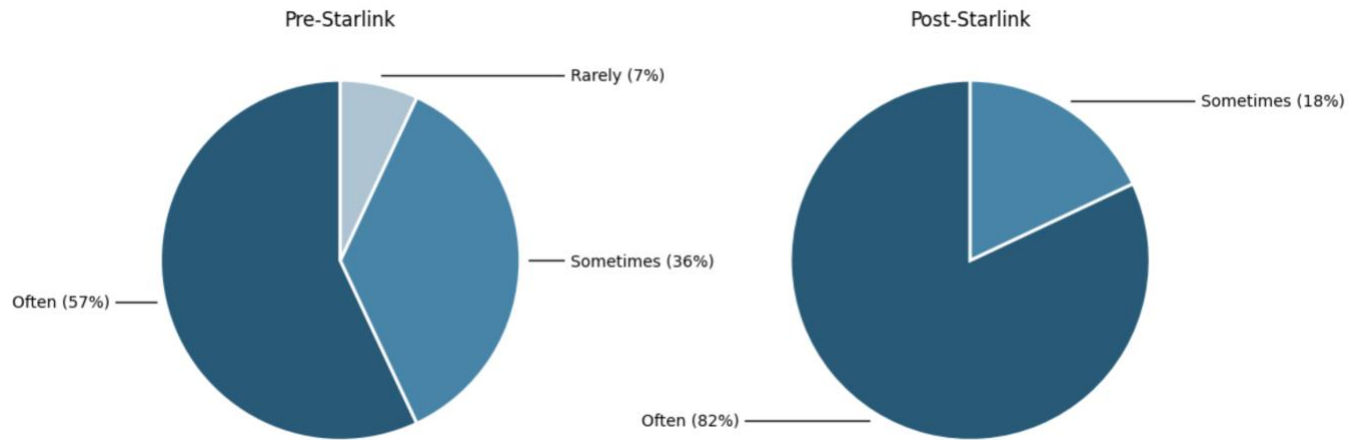


Figure 4.1: Frequency of digital resources use by teachers

A Mann–Whitney U test indicated a statistically significant increase in the frequency of teachers’ use of digital resources following the implementation of Starlink ($U = 289.0, p = 0.036$). Although the effect size was small to moderate ($r = 0.23$), this should be interpreted in light of the relatively small sample size.

Change in teachers’ use of digital resources post-Starlink

The findings indicate that most teachers experienced a notable increase in their use of digital resources following the introduction of Starlink connectivity. A majority of Heads of Institution (64%) reported a substantial increase in teachers’ use of digital tools, while 25% observed a moderate increase. Only 11% indicated no change. These results suggest that improved internet access has had a strong positive impact on the integration of digital resources in teaching practices.



Figure 4.2: Use of digital resources by teachers

Schools’ use of digital resources to support instruction

The survey further shows that digital resources are most commonly used across multiple instructional activities as depicted in Figure 4.3. The largest proportion of respondents (43%) reported that digital tools were used for lesson preparation, lesson delivery, learner assessment, and remedial support. Following the introduction of Starlink, there was a general increase in usage across all four instructional areas. The most notable improvements were observed in learner assessment and remedial support, while lesson delivery remained consistently high both before and after implementation.

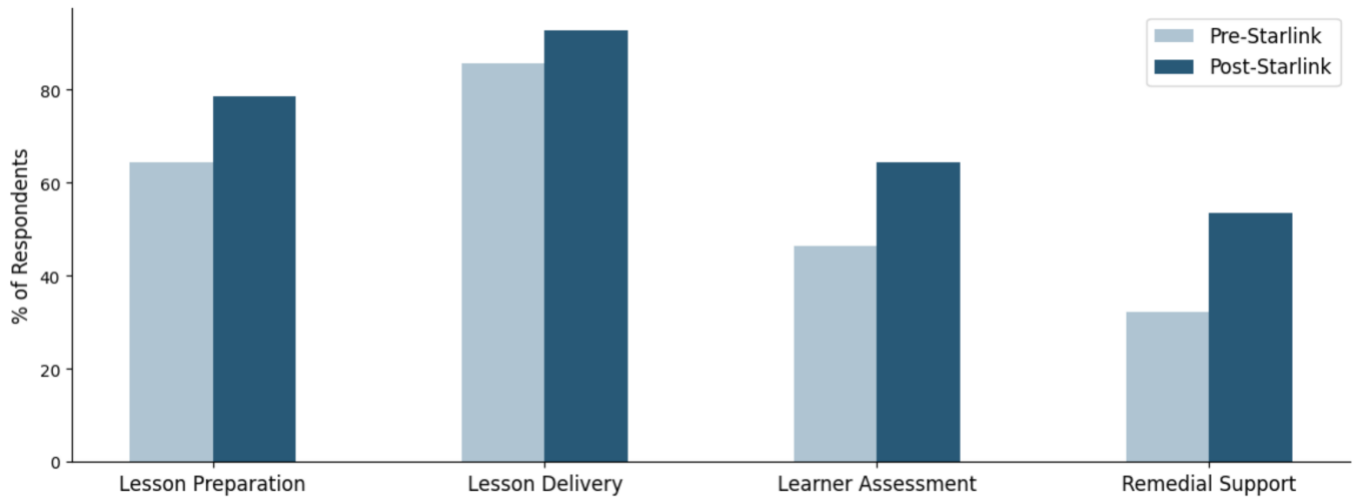


Figure 4.3: Areas where teachers use online resources the most

A Wilcoxon signed-rank test indicated an increase in the number of instructional areas in which digital resources were utilized; however, this change was approaching statistical significance ($W = 71.0, p = 0.065$). This result most likely be attributed to the relatively small sample size rather than the absence of a meaningful effect. Overall, the findings point to a broader and more integrated use of digital resources across teaching practices.

Schools’ use of digital resources to support assessment

A similar pattern of expansion is evident in the use of digital tools for assessment (see Figure 4.4). Prior to the implementation of Starlink, a considerable proportion of schools (36%) reported not using digital assessment tools. This figure declined substantially to 11% post-implementation. At the same time, there was increased use of online-generated assessment analysis, along with the introduction of more advanced tools such as digital portfolios, which were not utilized prior to Starlink connectivity.

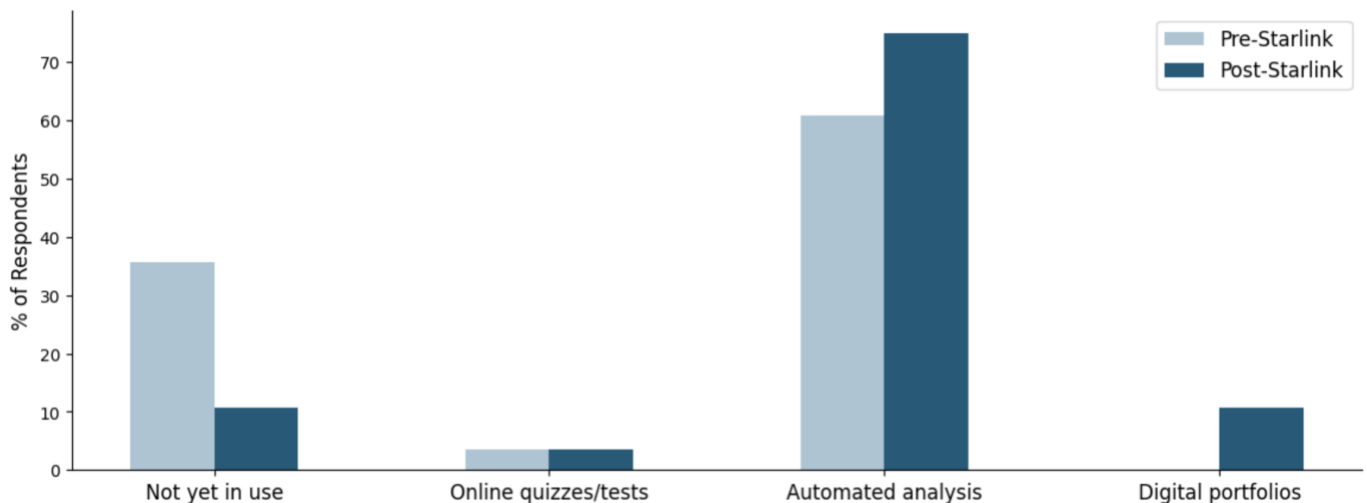


Figure 4.4: Use of digital tools to support assessment

A Wilcoxon signed-rank test confirmed that this change was statistically significant ($W = 12.0, p = 0.026$), indicating a meaningful improvement in both the adoption and sophistication of digital assessment practices. Overall, these findings demonstrate a clear shift toward more data-driven and diversified approaches to assessment following the introduction of Starlink.

Existence of Information and Communication Technology (ICT) guidelines supporting digital learning

Prior to Starlink implementation, 46% of schools reported having established ICT guidelines, 32% were still developing them, and 21% had none in place (see Figure 4.5). Following the introduction of Starlink, the proportion of schools with established ICT guidelines increased substantially to 61% (an increase of 15 percentage points). At the same time, the proportion of schools without any guidelines declined sharply to just 4% (a decrease of 17 percentage points).

These findings indicate that nearly all participating schools are now either implementing or actively developing ICT guidelines to support digital learning. Overall, the results suggest that improved connectivity through Starlink has contributed to a system-wide shift toward more formalized and institutionalized support for the integration of digital technologies in education.

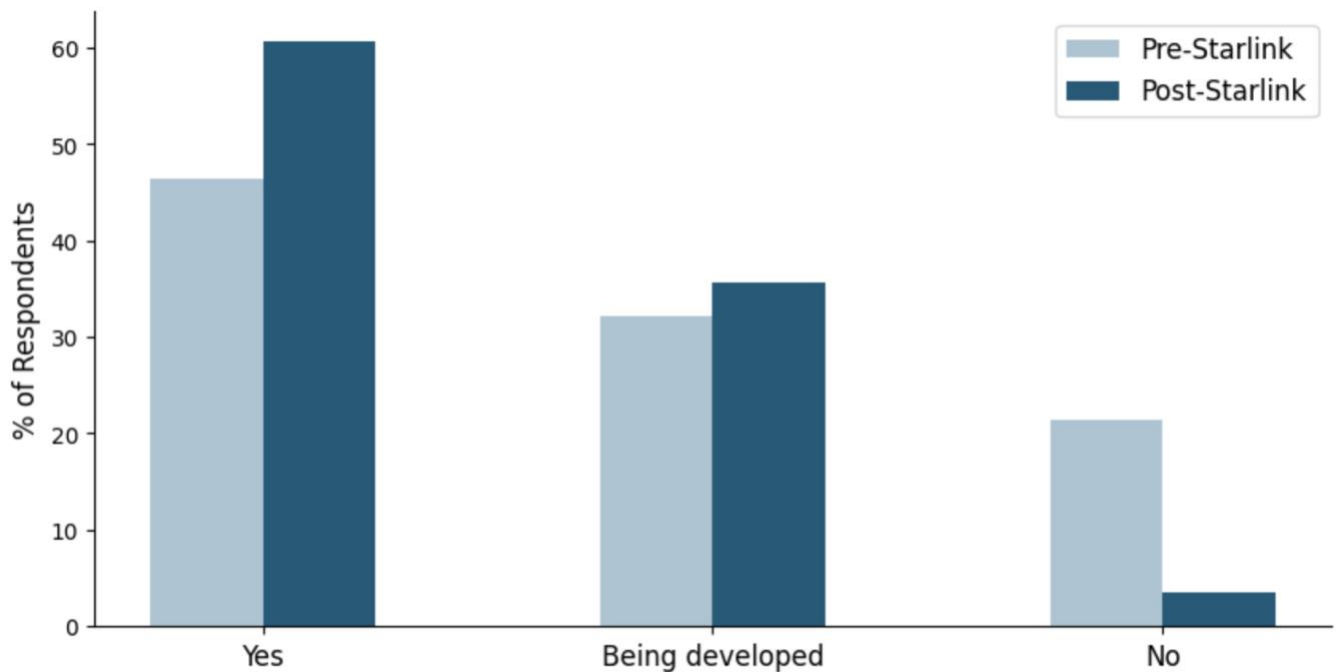


Figure 4.5: Presence of guidelines supporting digital learning use

Type of support teachers need to effectively use ICT

As evident in Figure 4.6, a clear shift is observed in the type of support Heads of Institution reported teachers need to effectively use ICT at their schools following the implementation of Starlink. Prior to its introduction, the most commonly identified need was technical skills training, reported by the majority of respondents (79%). Following

implementation, this need for technical skills training declined to 57%, indicating a reduced emphasis on basic technical competencies.

At the same time, demand for more advanced and sustained forms of support increased. In particular, digital pedagogy training rose from 64% to 82%, while ongoing coaching or professional development increased substantially from 39% to 71%, becoming one of the most prominent support needs. In contrast, needs related to access to quality content and time for lesson planning remained relatively stable across both periods.

Overall, these findings suggest a transition from foundational technical support toward more sustained, pedagogically focused forms of continuous professional development, reflecting a mature and integrated use of digital technologies in teaching and learning.

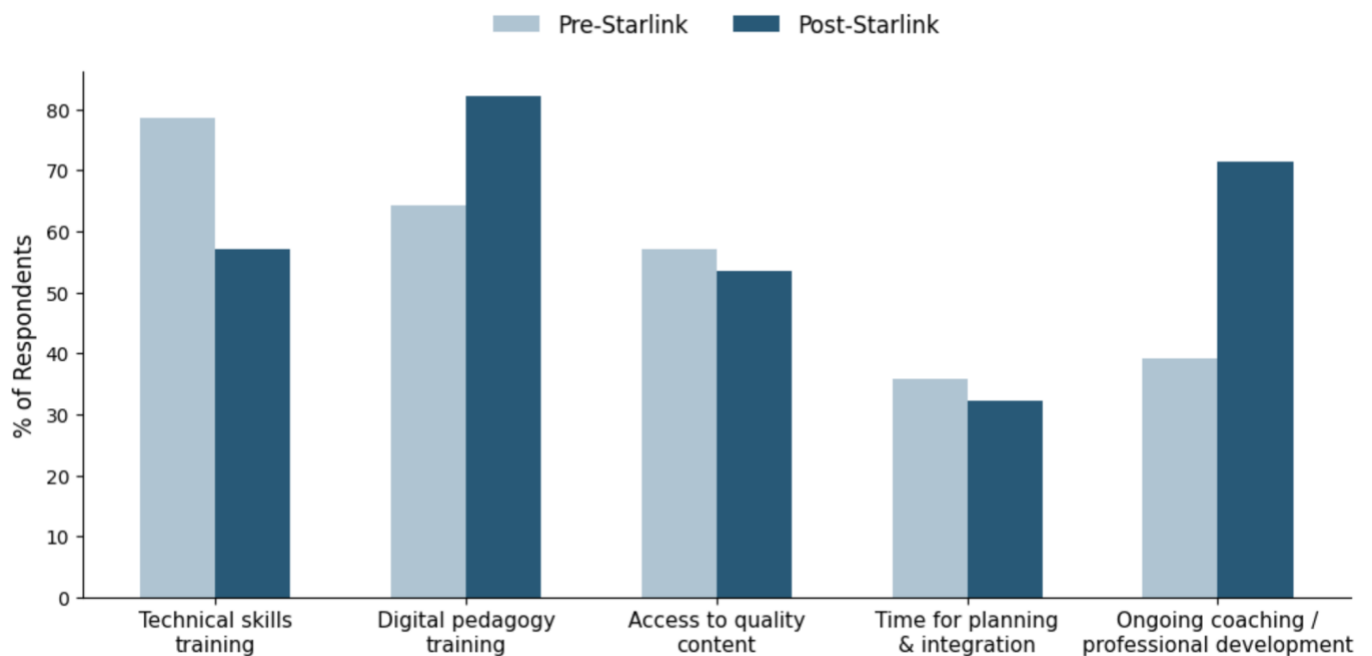


Figure 4.6: type of support teachers need to effectively use ICT

5. LEARNER-RELATED QUESTIONS

Learners’ ability to use digital technologies in school

Figure 5.1 shows a clear improvement in learners’ ability to use digital technologies following the introduction of Starlink connectivity. Prior to implementation, most learners were able to participate in ICT lessons (82%); however, fewer demonstrated independent or more advanced digital skills, such as logging into platforms without teacher support (46%) or completing digital assignments (18%).

Following implementation, there was a substantial increase in learners’ independent use of digital tools. The proportion able to log into digital platforms without assistance rose markedly from 46% to 79% (an increase of 33 percentage points). Similarly, the percentage of learners completing digital assignments increased from 18% to 36%,

while those collaborating online with peers grew from 25% to 32%. Furthermore, participation in ICT lessons remained consistently high (82% to 79%).

Additionally, the proportion of learners unable to perform any of the listed digital tasks declined from 7% to 4%. Overall, these findings indicate a shift from basic participation toward more independent, active, and collaborative engagement with digital technologies among learners.

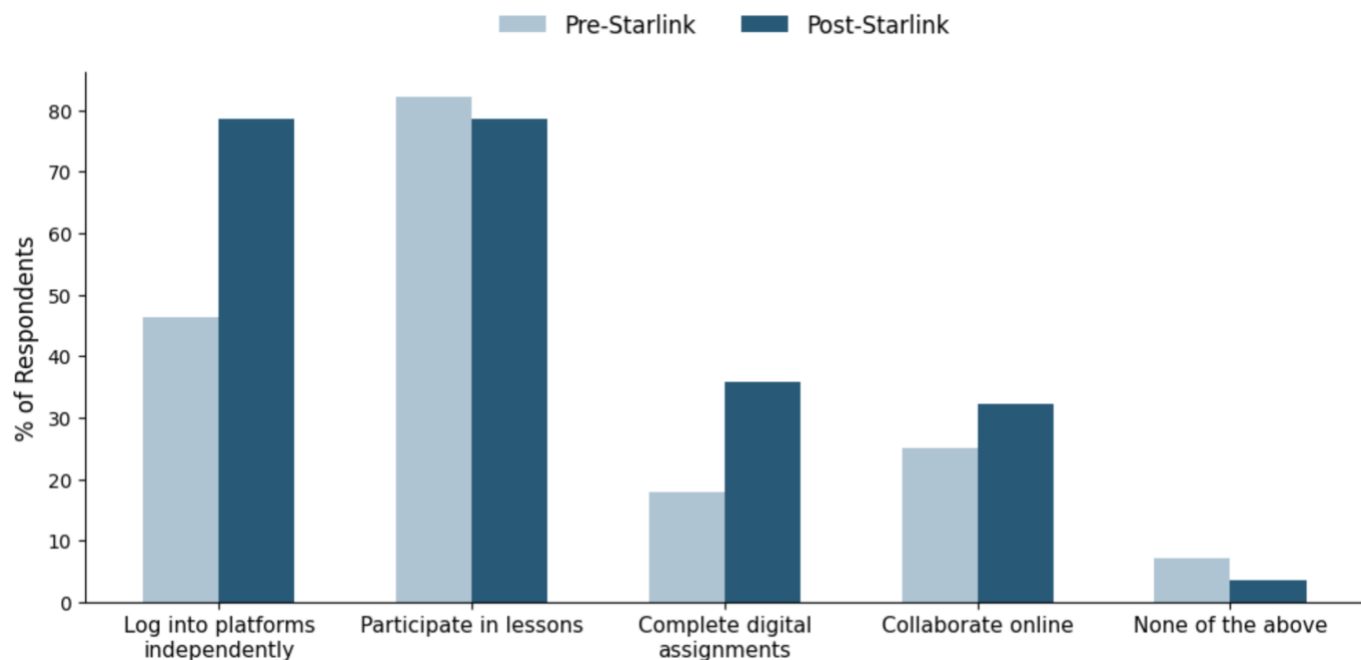


Figure 5.1: Learners’ ability to utilize digital learning tools

Learners’ interest when participating in ICT integrated lessons

A clear improvement is observed in learners’ level of interest when participating in ICT-integrated lessons following the introduction of Starlink (see Figure 5.2). Prior to Starlink, learner engagement was relatively mixed, with equal proportions reporting *moderate* and *very high* levels of interest (39% each), alongside smaller proportions reporting *high* (18%) and *low* (4%) levels of engagement.

Following the Starlink implementation, there was a marked shift toward higher levels of interest, with the proportion of learners reporting *very high* engagement increasing to 50%, and those with *high* engagement rising to 39%. Combined, 89% of learners demonstrated *very high* or *high* levels of engagement post-Starlink, compared to 57% during pre-Starlink. In contrast, *moderate* engagement declined substantially to 11%, and *low* engagement was no longer reported. These findings highlighting the positive shift toward higher levels of learner interest and engagement in ICT-integrated lessons, the positive influence of reliable connectivity.

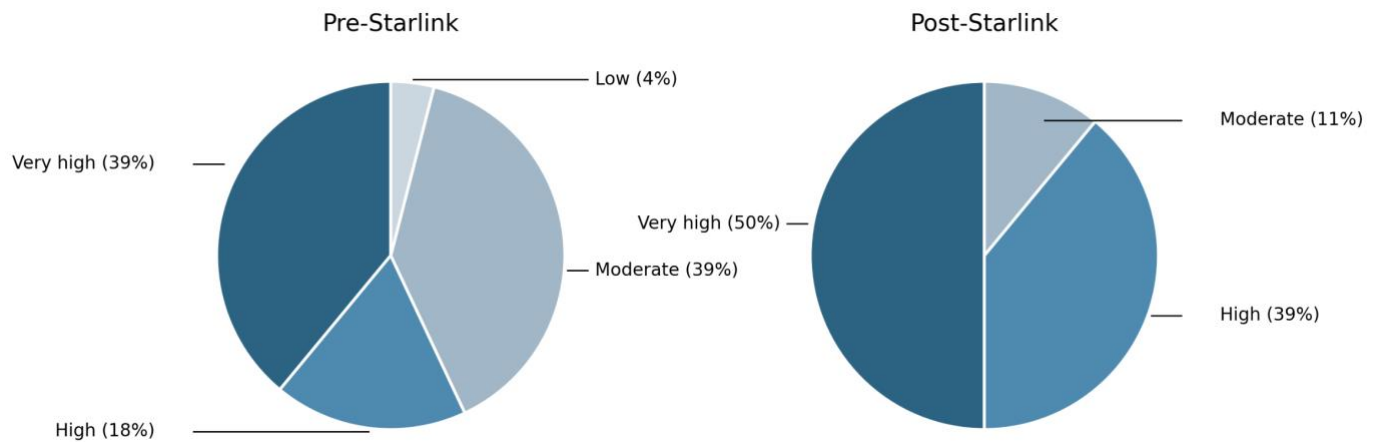


Figure 5.2: Learners' interest when participating in ICT

A Wilcoxon signed-rank test showed an increase in learners' level of interest following the introduction of Starlink; however, this change was approaching its statistical significance ($W = 57.5, p = 0.069$). This most likely was attributable to the relatively small sample size rather than the absence of a meaningful effect. Nonetheless, the descriptive results demonstrate a clear trend toward higher engagement, with substantial increases in *very high* and *high* interest and the elimination of *low* engagement.

Rate your school performance in STEM subjects

A clear improvement is observed in how schools rate their performance in STEM subjects following the introduction of Starlink connectivity (see Figure 5.3). Prior to implementation, the majority of schools rated their performance as *average* (68%), with smaller proportions reporting *above average* (14%) and *below average* (18%). Following implementation, there was a marked shift toward higher performance levels, with the proportion of schools rating themselves as *above average* increasing substantially to 43%. At the same time, the proportion reporting *average* performance declined to 46%, indicating movement into higher performance categories, while those reporting *below average* performance decreased to 11%.

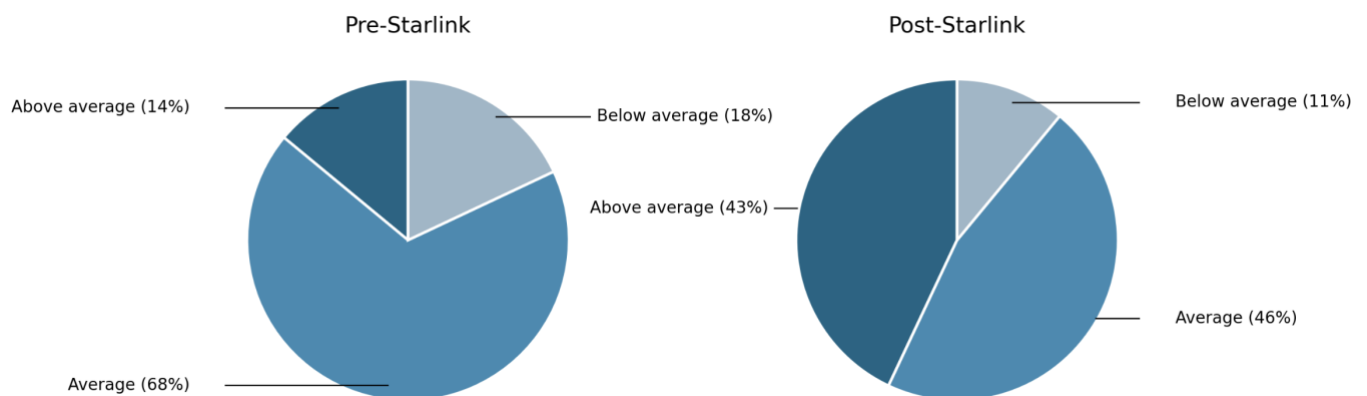


Figure 5.3: Learners' performance in STEM subjects

Overall, these findings suggest a positive shift in perceived school performance in STEM, with more schools transitioning from *average* to *above-average* outcomes. Although showing a clear upward trend, this change did not reach statistical significance ($W = 61.0, p = 0.080$; Wilcoxon signed-rank test), likely due to the limited sample

size rather than the absence of a meaningful effect. Future research would benefit from incorporating objective student-level performance data to more robustly assess learning outcomes.

Change in learners’ participation in digital learning since Starlink

The results indicate a substantial increase in learners’ participation in digital learning following the Starlink connectivity (see Figure 5.4). A majority of Heads of Institution (HoI) (64%) reported a notable increase in their learners’ participation, with a further 25% observed a moderate increase. Only a small proportion reported no change (7%) or a decrease (4%). These findings suggest that improved connectivity has had a strong positive impact on learner participation in digital learning, with nearly all schools experiencing some level of improvement.

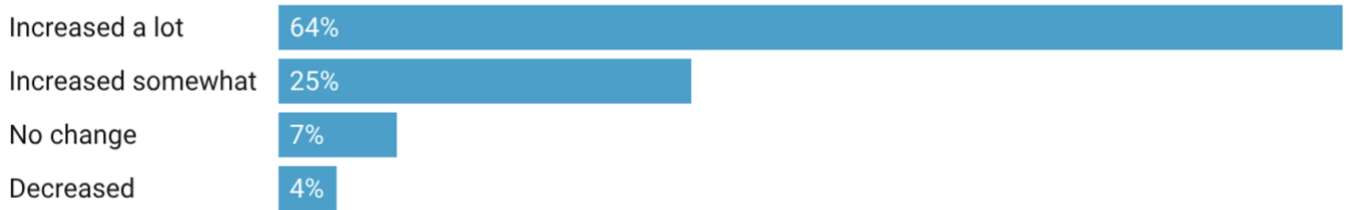


Figure 5.4: Learners’ participation in digital learning

Estimated percentage of learners using online resources (weekly)

Despite the reported increase in participation, the proportion of learners regularly using online resources remains relatively low in many schools. A majority of respondents (54%) indicated that only 0–10% of learners access online content on a weekly basis, while 36% estimated usage between 11–50%. Only a small proportion of schools (11%) reported that over 50% of their learners use online resources regularly. These findings suggest that regular and widespread use of online content among learners is still limited.



Figure 5.5: Percentage of learners using online contents

6. OTHER POST-STARLINK FINDINGS

Starlink performance assessment: Starlink dashboard data

As illustrated in Figure 6.1, which presents Starlink dashboard data from a representative sample school over a 30-day period, the connection demonstrates strong and reliable performance suitable for instructional use. This example reflects a typical pattern observed across many participating schools. The figure shows consistently low and stable latency (19–35 ms), minimal packet loss (typically near 0%), and negligible obstruction levels, indicating a well-installed system with minimal environmental interference. Signal quality remains high throughout the period

(up to 100%), with only minor and infrequent dips. This level of performance is adequate to enable common digital learning activities, including access to online resources, teacher-led instruction, and moderate simultaneous device usage.

While such Starlink performance represents a typically functioning case, dashboard data across schools also provide important insights into variation in performance. In some cases, reduced performance is associated with identifiable and addressable factors, including physical obstructions, satellite dish misalignment, use of lower-bandwidth Ethernet cables, and suboptimal placement of networking equipment. In addition, some schools are not fully utilizing additional nodes or network extensions, which may limit coverage and overall effectiveness of the connectivity within the school environment.

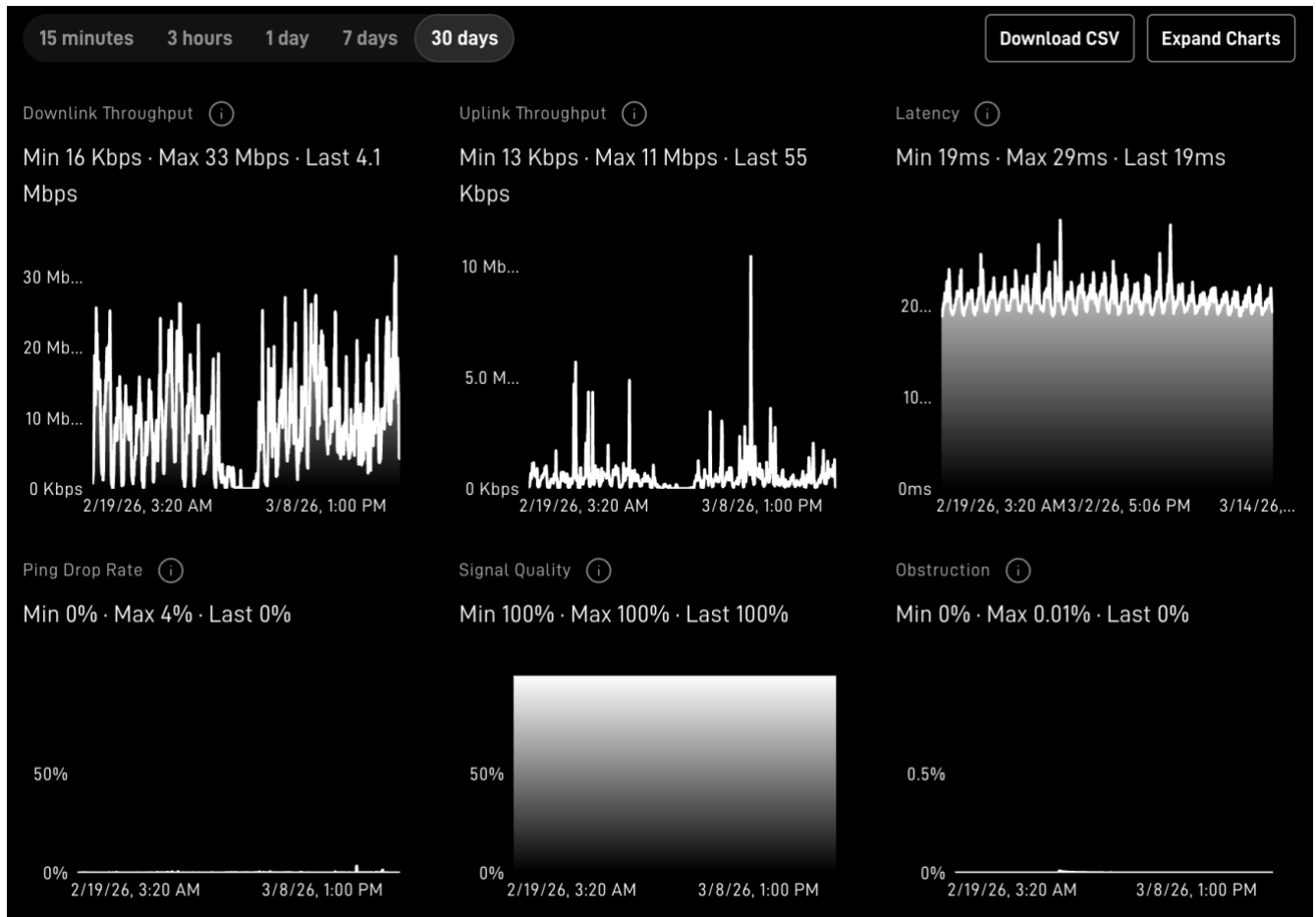


Figure 6.1: Starlink dashboard data showing 30-day performance for a representative school

Overall impact of Starlink on teaching and learning

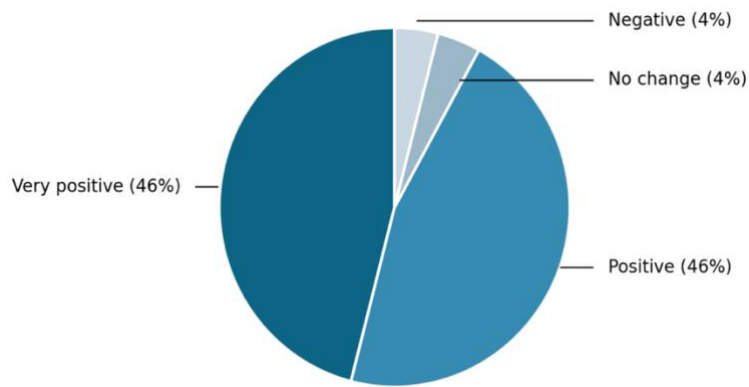


Figure 6.2 shows overwhelmingly positive perceived impact of Starlink on teaching and learning. A majority reported positive outcomes, with 46% describing the impact as *very positive* and a further 46% as *positive*, totaling 92% reporting improvement following the introduction of Starlink. In contrast, only a small proportion of respondents reported *no change* (4%) or a *negative* impact (4%). These minimal responses suggest that cases in which improved connectivity did not translate into positive outcomes were relatively rare.

Figure 6.2: Impact of connectivity on teaching and learning

Recommendation of Starlink to other schools

As evident from Figure 6.3, a vast majority of Heads of Institution (96%) indicated that they would recommend Starlink connectivity to other schools, while only one (4%) expressed that they might recommend it. This near-unanimous endorsement suggests a high level of confidence in the benefits of Starlink connectivity, including improved access to digital resources, enhanced teaching, and increased learner engagement as mentioned earlier in the report. The minimal level of uncertainty further reinforces the strength of this positive impact experienced across schools.

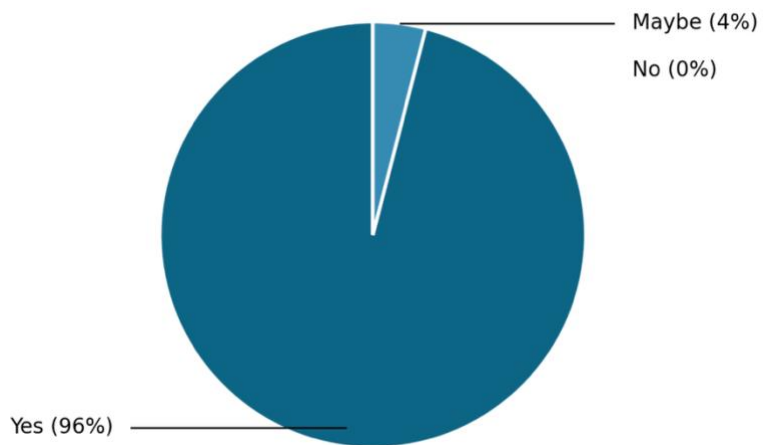


Figure 6.3: Recommending Starlink to other schools

Use of Starlink to support the broader community

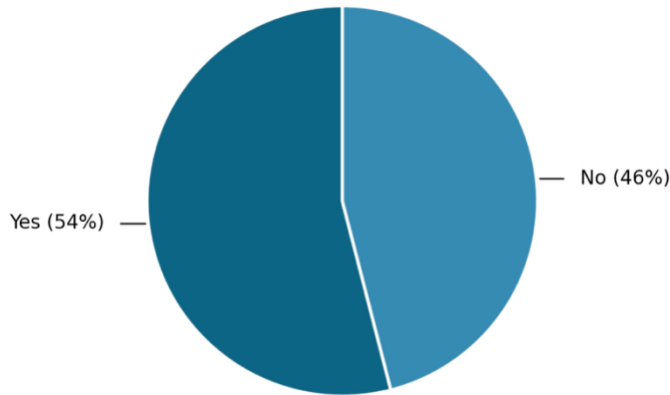


Figure 6.4 illustrates that over half of the schools (54%) are already using Starlink to support the broader community beyond the school.

The figure highlights a growing trend in which schools are extending the benefits of reliable internet access to learners, parents, and the wider community, demonstrating the potential of Starlink to serve as a valuable resource beyond the classroom.

Figure 6.4: The broader community usage of Starlink

Ways Starlink is used to support the broader community

The findings indicate that Starlink is being utilized in several complementary ways to support the broader community, with clear patterns emerging across responses. The most prominent uses include providing access for parents (25%), supporting after-school programs for learners (19%), and a combination of both (19%). Collectively, these account for approximately 63% of responses, suggesting that schools are primarily leveraging connectivity to strengthen family engagement and extend learning opportunities beyond school hours. A smaller yet notable proportion of schools (13%) reported using Starlink to provide public access to internet services. The remaining responses (25%) reflect a diverse range of additional community-oriented uses, including support for local organizational activities, access for nearby schools, and connectivity within teacher staff residences.

Overall, these findings suggest that schools are increasingly functioning as community digital access points. Connectivity is being used not only to enhance educational outcomes but also to address broader community needs, highlighting the role of schools as important hubs for digital inclusion and community engagement.

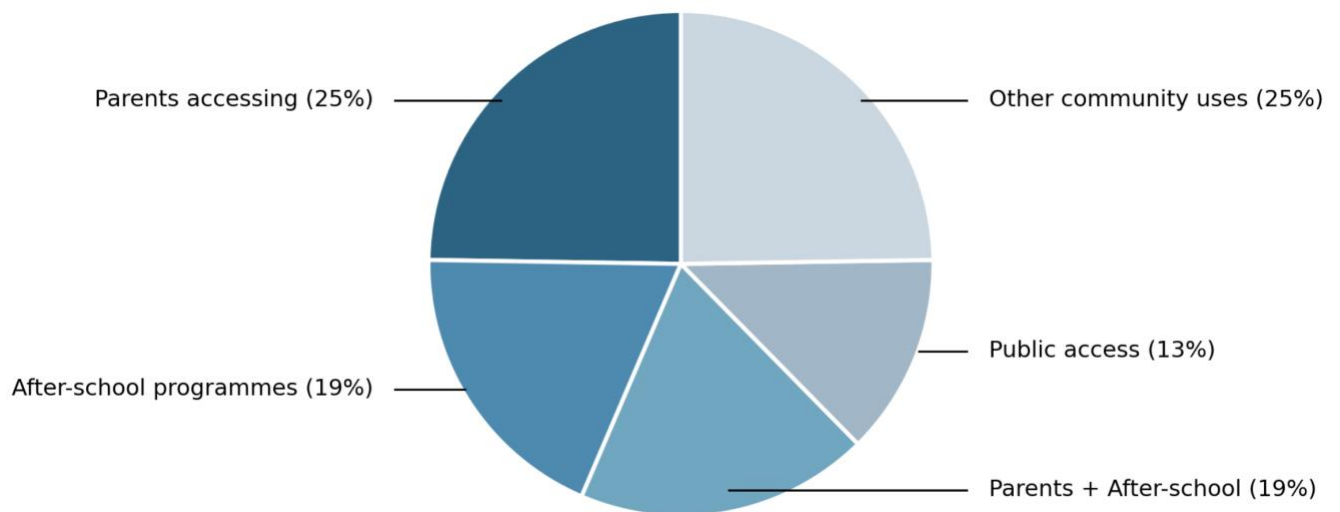


Figure 6.5: The usage of Starlink

7. OPEN-ENDED QUESTIONS

Describe your school’s supports for learners in ICT integration

The thematic analysis of open-ended responses reveals a clear shift in how schools support learners in ICT integration following the introduction of Starlink connectivity (see Figure 7.1). Prior to implementation, support was largely centered on foundational elements, including access to devices (59%), basic ICT instruction (37%), and initial classroom integration (37%). Responses from this phase commonly highlighted the provision of ICT equipment, the teaching of basic digital skills, and the occasional use of technology to support classroom activities.

Following implementation, there is a notable transition toward more integrated and pedagogically driven practices. Schools increasingly reported the use of digital technologies in teaching and learning processes (43%), improved learner engagement and access (39%), and enhanced system-level support (18%). These developments are reflected in the adoption of tools such as smart boards and digital lesson delivery, expanded opportunities for learners to conduct online research and complete digital assignments, and strengthened institutional capacity supported by reliable connectivity and ICT infrastructure.

Overall, the findings suggest a shift from basic access and introductory use toward more structured, integrated, and meaningful use of ICT to support learning.

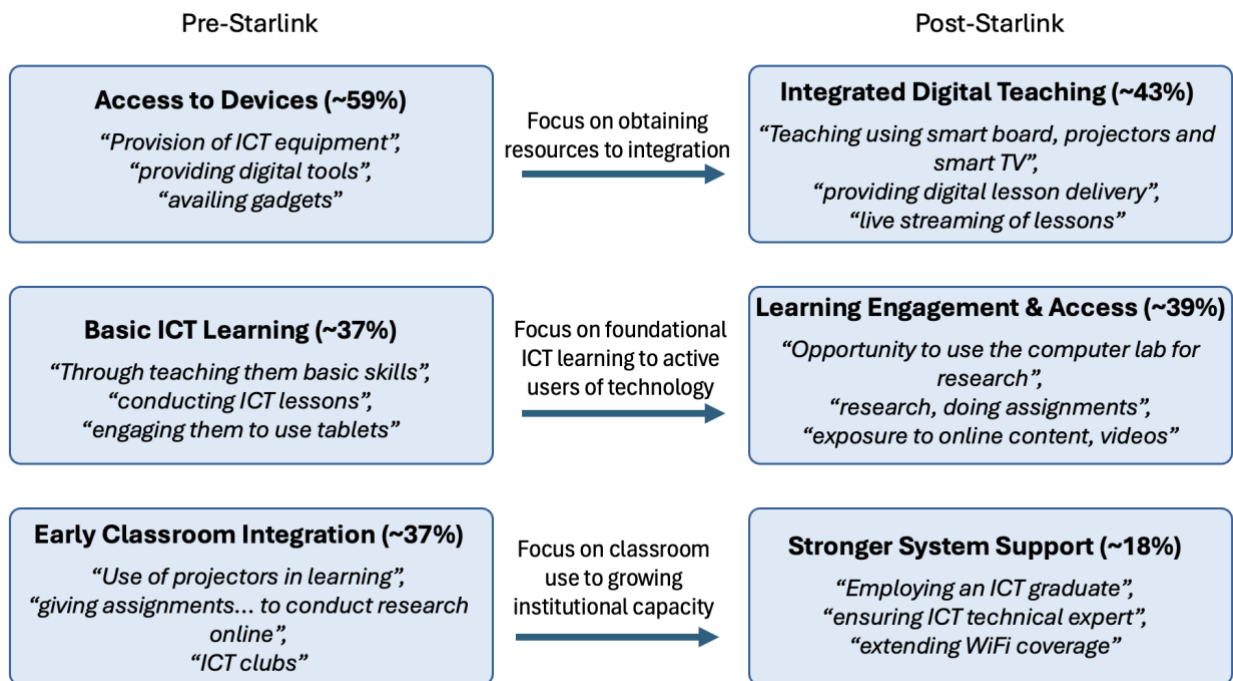


Figure 7.1: Changes in school supports learners in ICT integration

Describe the main enablers of successful ICT Integration

The thematic analysis of responses regarding the main enablers of successful ICT integration reveals both continuity and change following the introduction of Starlink, which is summarized in Table 7.1. Prior to implementation,

connectivity was the most frequently cited enabler (52%), although responses often highlighted challenges related to limited or unreliable access. This was followed by the availability of ICT devices (30%) and human capacity (26%), with schools emphasizing the importance of trained personnel and adequate equipment. Attitudes and interest (15%) were also identified as contributing factors, while institutional support (4%) was mentioned less frequently, suggesting limited system-level backing.

Following the introduction of Starlink, connectivity remains a key enabler (50%); however, the focus shifts from issues of access to those of reliability and stability. A notable change is the increased emphasis on devices and infrastructure, rising from 30% to 46%, reflecting efforts to expand ICT resources in response to improved connectivity infrastructure. Institutional support also increased (from 4% to 11%), with references to government involvement, ICT teams, and broader support mechanisms, indicating strengthened system-level capacity. In contrast, references to human capacity (11%) and attitudes (4%) declined, suggesting that these factors are becoming less constraining as ICT integration matures. Overall, the findings point to a transition from overcoming foundational barriers (e.g., access, training, and attitudes) toward enabling conditions that support sustained, scalable, and more advanced ICT integration.

Theme	Pre-Starlink (%)	Post-Starlink (%)	Examples	Interpretation
Connectivity	~52%	~50%	<i>"Internet connectivity", "Reliable and strong Internet connectivity", "Stable network", "Available reliable WiFi connectivity"</i>	Connectivity remains the core enabler, but shifts from concerns about access to emphasis on stability and reliability.
Devices & Equipment	~30%	~46%	<i>"Provision of ICT equipment", "Acquire laptops", "ICT devices", "Acquisition of additional ICT devices"</i>	Strong increase indicates a shift toward scaling infrastructure to fully utilize improved connectivity.
Human Capacity (Skills & Personnel)	~26%	~11%	<i>"Trained personnel", "Skilled personnel", "ICT knowledgeable staff"</i>	Decline suggests that training remains important but is less of a constraint post-connectivity.
Attitudes & Interest	~15%	~4%	<i>"Enthusiastic staff and learners", "Positive attitude towards ICT integration", "Increasing learners and teachers interest"</i>	Reduced emphasis indicates that positive attitudes are becoming embedded, rather than a primary barrier.
Institutional Support	~4%	~11%	<i>"Supportive BOM", "Government", "Supportive ICT team", "Supportive BOM and student body"</i>	Growth reflects increasing importance of system-level support and governance structures in sustaining ICT integration.

Table 7.1: Main enablers to ICT integration

Describe expected influence of Starlink on teaching and learning (pre-Starlink)

As summarized in Table 7.2, thematic analysis of responses reveals a strong and consistently positive outlook among Heads of Institution regarding the anticipated impact of Starlink on teaching and learning. The most prominent theme is the expectation of reliable and stable internet access (approximately 70%), with many respondents emphasizing that upgraded Starlink infrastructure would address existing challenges related to limited or unreliable internet. This underscores the foundational role of connectivity in enabling effective ICT integration.

Closely related to this is the expectation of enhanced teaching practices and ICT integration (approximately 50%), with several respondents describing Starlink as a “game changer” that would facilitate the use of digital tools and improve instructional delivery. Similarly, many anticipated improved access to digital learning resources and research opportunities (approximately 50%), enabling learners to access information more easily, conduct independent research, and engage with online content. In addition, increased learner engagement and participation (approximately 45%) emerged as a key expectation, with respondents suggesting that Starlink connectivity would make learning more interactive and motivating for both learners and teachers. Some responses also highlighted anticipated gains in efficiency and communication (approximately 30%), reflecting expectations of smoother information sharing and coordination within schools.

Theme	Percentage	Examples
Connectivity / Reliable Internet	~70%	<i>“Stable internet connectivity”, “Provide reliable Internet connection”, “Making internet connection stable”</i>
Teaching & ICT Integration	~50%	<i>“ICT integration will go a long way”, “ICT integration will be a game changer”, “Encourage ICT integration in teaching and learning”</i>
Access to Learning Resources & Research	~50%	<i>“Access a lot of material”, “Students able to research”, “Discover on their own”</i>
Learner Engagement & Participation	~45%	<i>“Learning will be interesting”, “Motivates teachers and students”, “Improve learner participation”</i>
Efficiency & Communication	~30%	<i>“Efficiency in teaching”, “Easy communication”, “Cut down cost”</i>

Table 7.2: How Starlink connectivity is expected to influence teaching and learning

Describe the changes in teaching and learning following Starlink (post-Starlink)

The thematic analysis of responses indicates overwhelmingly positive changes in teaching and learning following the introduction of Starlink connectivity, with improvements observed across multiple dimensions (see Table 7.3).

The most prominent change is the availability of reliable internet access (approximately 75%), with many respondents reporting the elimination of connectivity interruptions and consistent access to online resources for both teachers and learners. Closely related to this is enhanced access to digital content and learning materials (approximately 70%), including the ability to download notes, access online resources, and incorporate digital content into lesson preparation and learner activities.

These improvements have contributed to more effective teaching practices, with around 60% of responses indicating that teachers are better equipped to prepare lessons, access relevant materials, and deliver content more effectively. Increased learner engagement and participation (approximately 55%) also emerged as a key outcome, with respondents noting that learning has become more interactive, engaging, and motivating.

In addition, a stronger culture of research and independent learning (approximately 50%) has developed, as both teachers and learners are now able to explore information more freely. Improvements in efficiency and time management (approximately 40%) were also reported, with faster access to information supporting more effective use of instructional time.

Further, there is evidence of increased ICT integration and collaborative learning (approximately 35%), as digital tools are more consistently embedded in teaching practices and learners engage in shared digital activities. A shift toward more positive attitudes and confidence in using ICT (approximately 25%) was also observed. Only a small proportion of responses (approximately 10%) reported limited impact, primarily due to the recent rollout or incomplete connectivity.

Theme	Percentage	Examples
Increased access to internet & connectivity	~75%	<i>"All persons accessing internet with no challenges", "No more Internet connectivity interruptions", "Reliable Internet connectivity"</i>
Access to digital content & resources	~70%	<i>"Access to online materials", "Download digital content for projects", "Access necessary online content at the right time"</i>
Improved teaching practices	~60%	<i>"Teachers can effectively get relevant content", "Lesson preparation improved", "Teachers downloading notes and exams"</i>
Learner engagement & participation	~55%	<i>"Increased learners' interest", "Learning has become interesting", "Improved learner participation"</i>
Increased research & learning culture	~50%	<i>"Teachers can research freely", "Inculcated research culture", "Learners exploring more information online"</i>
Efficiency & time saving	~40%	<i>"Saving time and getting correct content", "Easy access to content", "Simplified teaching and learning process"</i>
ICT integration & collaboration	~35%	<i>"Enabled ICT integration", "Use of digital devices in lesson delivery", "Collaborative learning"</i>
Positive attitudes toward ICT	~25%	<i>"Teachers have developed strong positive attitude", "Motivated teachers and learners"</i>
Minimal / no impact	~10%	<i>"Operational for just one week", "Connectivity incomplete"</i>

Table 7.3: How Starlink is expected to influence teaching and learning

PART VI: CONCLUSION

This study provides compelling early evidence that reliable internet connectivity, delivered through Starlink, acts as a foundational catalyst for transforming teaching and learning in Kenyan school systems. By integrating findings across connectivity performance, instructional practices, learner outcomes, and system-level changes, a clear and coherent pattern emerged: enhanced connectivity infrastructure initiates a chain of changes that extend from infrastructure to pedagogy, and ultimately to learner engagement and participation.

Connectivity as a foundation for change

The most immediate and statistically robust improvements were observed in Starlink’s connectivity performance, including reliability, speed, and issue resolution. These gains are not merely technical improvements; they represent a critical shift in the underlying conditions necessary for digital learning. Prior to Starlink, connectivity was a constraint. They were unreliable, slow, and inconsistent. Following implementation, connectivity became an enabling resource, providing stability, speed, and reliability needed for teaching and learning in modern education.

This transition is central to understanding the broader findings of the study. The significant effect sizes observed in connectivity reliability ($r = 0.47$) and speed ($r = 0.52$) indicate not only statistical significance but also meaningful practical impact. As a result, schools were able to move beyond intermittent and constrained use of digital tools toward more consistent and embedded integration within teaching and learning processes.

From Access to Integration: Shifts in Teaching Practices

Improved connectivity translated directly into changes in instructional practice. Teachers increased both the frequency and scope of digital resource use, with a significant rise in those using digital tools “often” and a corresponding decline in infrequent use. More importantly, digital tools began to be used across multiple instructional domains (e.g., lesson preparation, delivery, assessment, and remediation), indicating an integrated instructional practice.

This progression reflects a movement towards more digital maturity. For example, prior to Starlink, ICT use was largely supplementary and access-driven. Post-Starlink implementation, it became more embedded and pedagogically meaningful. The increased use of digital assessment tools, including the emergence of more advanced practices such as digital portfolios, further suggests a change toward student data-informed teaching.

At the same time, the nature of teacher support needs evolved. The decline in demand for basic technical training alongside increased demand for digital pedagogy and ongoing professional development signals a critical transition, that teachers are no longer primarily struggling with *how to use technology*, but with

how to use it effectively for teaching. This shift is a strong indicator of system progression from adoption to integration.

Learner Outcomes: From Participation to Engagement and Independence

At the learner level, the findings demonstrate a consistent pattern of improvement across multiple dimensions: participation, engagement, digital skills, and perceived academic performance. Learners are not only participating more in digital learning, but are also engaging more deeply and independently.

The substantial increase in learners' ability to perform tasks such as logging into platforms independently and completing digital assignments reflects growth in digital literacy and agency. Similarly, the marked shift toward higher levels of interest in ICT-integrated lessons suggests that Starlink is contributing to more engaging and interactive learning.

However, an important nuance emerges. While learner participation in digital learning has increased significantly, regular use of online resources remains relatively limited in many schools. This gap points to a critical structural constraint: limited access to devices and high learner-to-device ratios. Without expanding access to devices, the full benefits of enhanced connectivity infrastructure cannot be fully realized. In other words, while connectivity has enhanced access at the system level, access at the individual learner level remains unmet.

System-Level Changes: Institutionalization of ICT Integration

Beyond classroom practices, the study reveals important system-level developments. The increase in schools with established ICT guidelines, the expansion of ICT support roles, and the growing emphasis on institutional support all point toward the formalization of digital learning within school systems.

These changes suggest that connectivity is not only influencing individual behaviors but also driving organizational shifts. Schools are moving toward more structured and sustainable approaches to ICT integration. This is further reinforced by qualitative findings showing a shift from foundational concerns (e.g., access, basic skills) to capacity-building conditions (e.g., infrastructure scaling, system support).

Extending Impact Beyond the Classroom

One of the most notable findings is the extension of connectivity benefits beyond the school environment. Over half of the schools reported using Starlink to support the broader community, including parents, after-school programs, and local organizations. This positions schools as emerging hubs of digital access and inclusion.

This broader community engagement highlights the potential of Starlink connectivity contributing not only to educational outcomes but also to community development and digital equity. It also highlights an important pathway for maximizing return on investment in connectivity infrastructure.

Alignment Between Expectations and Outcomes

A comparison of pre- and post-Starlink connectivity qualitative findings reveals strong alignment between expectations Kenyan schools envisioned and actual outcomes as the result of their participation in the pilot study. Schools anticipated improvements in connectivity, access to resources, teaching effectiveness, and learner engagement. These expectations were largely realized within a relatively short implementation period of 30 days.

Persistent Constraints and the Limits of Connectivity

Despite these positive developments, the findings also highlight important limitations. Chief among these is the persistent constraint of limited device access. High learner-to-device ratios continue to restrict equitable participation in digital learning, even in the presence of strong connectivity.

Additionally, some schools continue to face implementation-related challenges, including power stability, equipment setup, and network configuration, which contribute to variability in connectivity performance across contexts. Insights from Starlink system dashboards further indicate that in certain cases, reduced performance is associated with identifiable and addressable factors such as signal obstructions, suboptimal dish alignment, LAN cable limitations, and ineffective node placement.

Importantly, these challenges are largely technical and can be readily mitigated through targeted onboarding, ongoing training, and continued technical support. We note that such challenges are independent of Starlink's operating capability and Scope of Work; rather they reflect implementation related challenges that will continue to stunt full realization of Starlink's potential impact. Addressing these issues through dedicated third-party support and local technical assistance on the ground will be critical to ensuring more consistent and optimal connectivity performance across all schools.

Furthermore, several outcomes (e.g., improvements in STEM performance and learner engagement) while clearly positive in direction, did not reach statistical significance. This is likely due to the small sample size and short duration of exposure rather than the absence of real effects. These findings should therefore be interpreted as strong early signals rather than definitive long-term impacts.

Implications for Scaling and Policy

The findings of this study carry important implications for scaling connectivity interventions. First, they demonstrate that connectivity can act as a powerful foundational driver for system-level shift in education, but only when combined with complementary investments.

To sustain and scale impact, policymakers and involved parties should prioritize:

- Expanding access to devices to reduce learner-to-device ratios
- Strengthening teacher professional development, particularly in digital pedagogy
- Enhancing ICT support structures within schools

- Providing technical onboarding training and ongoing support for connectivity systems
- Developing and institutionalizing ICT policies and guidelines

Importantly, successful scaling will also require strong engagement with local communities and education partners to ensure contextual relevance, ownership, and sustainability model.

Future Research Directions

As an early-stage impact study, the present findings highlight the need for further research to more rigorously assess the long-term, causal effects of improved connectivity, as well as the extent to which these results can be generalized across different contexts.

Future research should prioritize larger and more diverse samples to address current limitations related to sample size and statistical power. **Expanding the number of participating schools (larger N) will enable more robust analyses, increase the reliability of findings, and support stronger conclusions about the impact of connectivity on teaching and learning.**

In addition, extending this research to include more diverse student populations across different regions and countries will be critical for assessing generalizability. Educational systems vary widely in terms of infrastructure, resource availability, policy environments, and levels of digital readiness. Understanding how connectivity interventions perform across these varied contexts is essential for identifying the conditions under which they are most effective and for informing scalable, globally relevant implementation strategies.

To build a more comprehensive and rigorous evidence base, future studies should also incorporate:

- **Objective measures of student learning outcomes**, including standardized assessments and performance data
- **Longitudinal research designs** to track changes over time and assess the sustainability of impact
- **Comparative or control group designs** to strengthen causal inference
- **Deeper analysis of equity**, particularly in relation to device access, gender, and regional disparities

By addressing these areas, future research can move beyond early signals of impact to provide stronger, more generalizable evidence on how connectivity can drive meaningful, equitable, and scalable improvements in teaching and learning across diverse educational contexts.

PART VII: REFERENCES

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